Improving COLLEGE AND UNIVERSITY *Teaching*

Journal Sabbatical Year: 1959

THE EDITOR'S UNEASY CHAIR

Teaching with Books.....Frederick Mayer
University of Redlands

Twelve Suggestions for Improving Teaching.....Ordway Tead
Chairman, Board of Trustees
Briarcliff College

Neglected Purposes in Higher Education.....John E. Horner
University of Omaha

EXAMINATIONS AND GRADES

Editorial: The Game of Grades

What Do College Grades Mean?.....Joseph Axelrod
San Francisco State College

Improving Testing and Marking Practices.....Laurence Elliott Tomlinson
Lewis and Clark College

Using Examinations to Promote Learning.....Janet Bassett Baker
Marywood College

The Examination.....Winslow R. Hatch
United States Office of Education

How Is Your Diction?
A Review by A. M. Withers

OTHER RECENT BOOKS

SIXTH YEAR AUTUMN 1958 VOL. VI, No. 4

Improving College and University Teaching

A NATIONAL QUARTERLY JOURNAL
FEATURING ARTICLES ON COLLEGE TEACHING
WRITTEN BY COLLEGE TEACHERS

Editor: DELMER M. GOODE

Publisher: *The Graduate School*
Oregon State College
Corvallis, Oregon

NATIONAL EDITORIAL ADVISORY BOARD

Lloyd E. Blauch.....Assistant Commissioner for Higher Education, U.S. Office of Education

Lawrence H. Chamberlain....Dean of Columbia College, Columbia University

W. H. Cowley .....David Jacks Professor of Higher Education, Stanford University

Bernice Brown Cronkhite.....Dean of the Graduate School, Radcliffe College

Edwin D. Duryea.....Dean of the Evening Program, Hofstra College

Winslow R. Hatch.....Research Coordinator (Higher Education), U. S. Office of Education

Joseph Justman.....Professor of Education, Brooklyn College

William Charles Korfmacher....Professor of Classical Languages, Saint Louis University

Wilbert J. McKeachie.....Associate Professor of Psychology, University of Michigan

Walter H. Mais.....Professor of Physics, Dean of the Faculty, Brooklyn College

Max S. Marshall.....Professor of Microbiology, University of California Medical Center

Ordway Tead....Member of Board of Higher Education, New York City; Chairman, Board of Trustees, Briarcliff College

GRADUATE SCHOOL

George W. Gleeson....Dean of the School of Engineering

Henry P. Hansen.....Dean of the Graduate School

J. Kenneth Munford.....Professor of English and Higher Education

Frank L. Parks.....Associate Professor of Sociology

Franklin R. Zeran.....Dean of the School of Education

Entered as second-class matter, March 22, 1954, at the Post Office at Corvallis, Oregon, under the Act of August 24, 1912.

Copyright 1958 by Oregon State College

Subscription price
$2.00 a year
Two years $3.50

Address: 107 Commerce Hall
Oregon State College
Corvallis, Oregon

Journal Sabbatical Year: 1959

WITH THE WINTER 1959 ISSUE this journal will begin its seventh year of publication. For a professor a sabbatical year may mean opportunity for rest, research, writing, or travel. For a journal a sabbatical year, though a gratifying stage of experience, means something quite different.

This journal, for example, will do no resting. Its editor and the expanding circle of its contributors will go right on writing. Subscription-wise the journal will continue to go into every state and beyond the national borders—to more and more campuses, it is hoped, and to more and more subscribers. Mindful of its debt to contributors, subscribers, and friends for its progress to date, the journal will count on the continued help of all its friends in making this sabbatical year a fruitful one in its growth and development.

Articles on college and university teaching written by college and university teachers will continue to be a feature of this journal. These articles will continue to deal with problems of the classroom and laboratory as analyzed by faculty people in all sections of the nation. It is hoped also that from time to time there will be contributions concerned with the philosophy of teaching and the professional interests and relationships of scholars teaching.

Volume VII Begins with the Winter Issue

"The purpose of college teaching is to induce self-propelled intellectual activity on the part of the student."

The college student and the concern of the faculty for him will be the dominant theme in the next issue with articles by Arthur S. Adams, President of the American Council on Education, Max S. Marshall (California), Ordway Tead (New York), Paul Douglass (Florida), Herbert Stroup (New York), Edwin E. Vineyard (Oklahome), Walter A. Coole (Texas). Editorial: "Which You Yourselves Do Know."

The issue will set a quality level for Volume VII of the journal.

Teaching With Books

By courtesy of the Public Affairs Press we are privileged to present a portion of one chapter of the new book "New Directions for the American University" by Dr. Frederick Mayer which was reviewed in the Spring issue. Of Dr. Mayer (Ph.D., Southern California) Dr. Benjamin Fine has written: "In my opinion Professor Frederick Mayer is one of the most brilliant thinkers of our time. His lucid style enables the reader to grasp the most difficult educational concepts. Dr. Mayer's knowledge, and his scholarly understanding of our twentieth century educational problems make him one of the nation's outstanding spokesmen of current educational thinking." Readers are referred to the article below and to Dr. Mayer's books for confirmation of this tribute.

By FREDERICK MAYER

WE CAN LEARN from the English experience in higher education by instituting a more extensive use of the tutorial system. A student at Oxford will meet his tutor once a week and he will read an essay to him. The tutor's criticism of the essay will be very thorough and he will demand that the student substantiate all points by factual evidence. Furthermore, additional reading references will be suggested and thus the student has to do work on his own.

Oxford and Cambridge both have encouraged debating societies and they have been training grounds for future prime-ministers. In our universities we ought to have far more clubs based on the vocational interests of students. There ought to be vital and enthusiastic philosophy clubs, sociology clubs, literary societies, astronomy clubs, history clubs, and they ought to promote competitive activities. Prizes should be given for the best piece of poetry, the best essay, the best musical composition and for other creative efforts. There should be a frequent use of outside lecturers and thus the isolation of the campus would be lessened. A word of encouragement! At Fresno State an experiment was undertaken. A class was divided into two parts: one was taught through television; the other was taught the normal way. An examination was given and the television class was superior to the conventional group. Through television, students will be able to hear master teachers and they will be able to visualize ideas. Television promises the same revolution that the invention of printing accomplished.

The expanding paper-book industry likewise offers promising prospects. Now a student for ten dollars can purchase a library with some of the foremost classics of the Western world. The universities should take advantage of this opportunity and offer more reading courses.

This does not imply that hardbound books should be slighted. On the contrary, the constant goal should be to have the students become active consumers for worthwhile books. Studies have indicated how limited the reading is of college graduates, especially in the field of non-fiction. This indicates our failure in creating concomitant interests and in bridging the gap between theory and practice.

Activity-minded, progressive educators often feel that our universities over-emphasize book learning. The trouble is the opposite; students engage in too much athletic reading, especially before an examination. To them a book is not a vital encounter, but an obstacle to be overcome.

To appreciate books with fervor is one of the primary aims of higher education. To value them as our ties with the past, as the unforgettable records of the present, and as the preludes to the future, is to become part of a perennial pilgrimage. It is inadequate to see culture as an encyclopedic event, as an exercise in classification. Only when the past becomes as real as the present, only when it is filled with warmth and awareness, when the works of men like Plato, Aristotle, Voltaire, and Emerson cease to be abstractions and become our constant companions do we really become active participants in the drama of learning.

Our college libraries contain millions of works. They are housed in imposing structures. But most students look upon the library as a research center, not as a treasure-house for the soul. They read superficially and often with apathy and they are exposed to anthologies which are "digests of digests."

If they learn to love books their entire existence will change. As persons they will have deeper insights. Old age will lose part of its terror, and time will be something purely phenomenal. Distance will have no meaning and the past will be as intriguing as the future. And they will

never be alone even in times of illness and despair. To love books is to see the ideal possibilities of humanity.

Books emancipate the thoughtful student from the bondage of immediacy. Read the autobiography of Richard Wright, of the oppression of his youth, of the prejudice against his race, of the constant fear, and the overwhelming ignorance of his environment—and how books to him became the symbols of liberation. He yearned for them like a prisoner looks forward to the day when his prison sentence ends. Many German university students likewise yearned for the literature of freedom when Hitler engaged in wholesale book-burning. To many Satellite students living under the Soviet yoke, Western books are symbols of a way of life which to them is almost like Utopia.

Most of our students, however, are not excited by books. They engage in too many social activities and they do not find enough time for contemplative reading. A teacher who can inflame their minds with the romance of books and who can make the authors real to them and who can dramatize the literary ideas of mankind, will have an unforgettable impact upon their lives.

The significant point in instruction is change of pace. A student in college, besides creative reading experiences, ought to be exposed to television education, to the formal lecture, to a laboratory experience, to discussions, to seminars, to tutorials, to the campus clubs. And he should have time for independent investigation and creative thinking. One of the most severe indictments of college life was made by Helen Keller when she said: "I came to college to think; instead I just had to read and memorize."

Genuine education leads from passivity to activity. Genuine education creates awareness. Genuine education leads to concentration so that the student realizes that he has a divine spark within himself.

In short, he sees the limitless possibilities of his own experience and he builds a bridge between the world of his dreams and the realm of actuality.

A Manley or a Missile?

"Dr. Frank Manley, the director of the Mott Foundation Program, which sparks Flint's Board of Education Community School operation, was, himself, a 'drop-out' in his youth. Fortunately he was able to return to school. And his progressive, educational insights brought him eventually to a position of leadership in his city of 200,000 people where he has awakened it to the rich personal and social fruits that grow on the tree of creative liaison between schools and sincerely interested communities. Who will venture to say that this marveous catalyst would not have been lost if some single-track system had 'dumped' Frank Manley as second-rate stuff? The priority question of the sciences and mathematics vs. the humanities in our post-Sputnik 'crash' scholarship program is not beside the point here. Which is more important to the nation's survival—a Manley or a missile?"

ROBERT LEWIS SHAYON
in Saturday Review, September 13, 1958

Twelve Suggestions for Improving Teaching

The "suggestions" here offered could profitably occupy a faculty conference for a whole week, a half day per topic. An individual professor, devoting his spare time for a week on each topic, might feel at the end of twelve weeks that he had had an experience surpassing the finest of home study courses. Dr. Tead, scholar, writer, speaker, Vice President of Harper & Brothers, member (former chairman) of the Board of Higher Education, New York City, chairman of the Briarcliff College Board of Trustees, has been a friend of this journal from its beginning and author of many distinguished contributions.

By ORDWAY TEAD

LET ME OFFER, in all too summary a form, a few specific suggestions to teachers about some steps in a program looking to instructional improvement in the classroom:

- Relate departmental and individual course objectives organically to the stated objectives of the institution.
- State departmental and course objectives in written form in the college catalog and in course syllabi for student consumption after faculty acceptance, and review these each year with one's colleagues interdepartmentally.
- Let each teacher be sure that he is on occasion supplying effective answers for his students to such questions as: Why should you study this course? What intellectual relation has it to other courses? What vocational and avocational implications may it have? What supplementary and secondary purposes are being sought beyond mastery of subject-matter? What intellectual methods have to be employed for competent understanding here? What are the likely and desirable outcomes for the students? Am I, by means of a sufficient variety of instructional methods, making this course a relevant and zestful experience for the student?
- Let each teacher be sure that every course, and every session of every course, be carefully planned with a beginning, a middle, and an end. And let him engage in self-scrutiny at the end of each day's work to see how class or laboratory performance is really progressing in relation to the plan.
- Let each teacher seek, through classroom visits, the criticism of those of his peers who have a reputation of being good teachers as to his effectiveness as a teacher. The notion that each teacher's classroom is sacrosanct and that he has the right to work in splendid and uncriticized isolation has to be abandoned.
- Watch the problem of the tempo of individual students in their learning. There should be a good digestion and a mastery of material before the teacher moves forward to new material. Students may differ appreciably in the tempo of their assimilative powers.
- Realize that the teacher, like the actor, has to project himself "over the footlights." There is a reasonable degree of showmanship which is legitimate and essential. There have to be some vibrancy and phosphorescence in the class-hour performance—some manifest excitement about the things of the mind and spirit. The teacher should be the exemplar of all this.
- Let the teacher realize that the periodic recognition of student success or conquest is invaluable; and to assure this requires something more personalized than the marking system. Similarly, there is a need for the specific personal encouragement of the discouraged and the failing.
- Let the teacher experiment with various types of classroom teaching methods, in order to introduce variety and to determine when and where different methods are more successful. As to one's approach to teaching methods, remember the dictum of Henry Adams: "Whatever else you do, never neglect trying a new experiment every year."
- Let the teacher reexamine each course each year to reassess objectives, to take account of difficulties encountered in the previous year, and to embody the most recent scholarship on the subject.
- Let the teacher ask himself whether or not he is interested in his students as people, as individuals. Does he realize some validity in the remark that "to evoke the love of learning, learn-

ing must be available in an atmosphere of love?" Does he agree that, as it has been said, "the good leader loves the led," so also is it true that the good teacher loves those being taught?

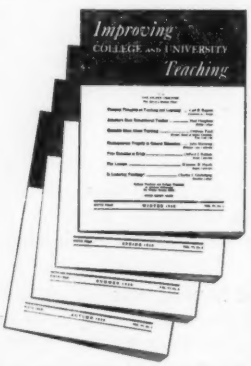
- A final and inclusive question needs to be self-posed. Does the teacher know the basic philosophic and cultural preconceptions, beliefs, and convictions with which he approaches his professional labors? Does he distinguish the premises of his subject from the premises, beliefs, and methods in other areas of human study and experience? Has he, in short, some *philosophy of life* which places his teaching in some larger frame of reference and significance?

In sum, my point is that we are charged to educate the man in his wholeness first, and the specialist second. That this is not a novel thesis or an impossible demand, the efforts of a variety of educational experiments seem to me clearly to establish.

I like to think that as we move into this broadened frame of purpose and vision we will be measuring up more closely to the test of wisdom hinted at by Henry Adams when he admonished us to "run direction through space, order through chaos, discipline through freedom, unity through multiplicity."

You Get A Book A Year

In six years of publication this journal has published a total of 576 pages of articles, editorials, reviews, and book lists. Each volume is indexed and is the equivalent of a good sized book. The distinction of these volumes in respect to scope, quality of authors and contributions, and geographical and institutional diversity can be judged by readers themselves.



← Four issues per volume.
One year $2.00
Two years $3.50

The Editor's Uneasy Chair

"John Scott will be a good subject," said the Dean. "He is our greatest failure." A trouble shooter had been summoned to deal with the problem of failing students. The facts sustained the Dean's statement. A greater contrast between potential and performance could hardly have been found.

How many John Scotts do we have?

John, a twenty-two year old senior, stood at the 96.5 percentile in the ACE psychological examination, in the top quartile in reading, and near the top in other tests. Yet he was the college's greatest failure.

Study of John indicated that the cause of failure was incipient mental illness, a slowly developing type of maladjustment—a surprising and distressing situation to find in a young man of high potential.

The cause ascribed is even more disturbing: John's mental deterioration was believed to have its basis in the fact that through grade and high school, and similarly in college, he had been treated like an average student, never really challenged, never brought into effective competition with his intellectual peers. "He needed opportunity to match ideas with students and teachers of ability equal to his own."

This story is told in Heaton and Weedon's "The Failing Student." Fortunately John had sufficient interest in his own reclamation to seek psychiatric help and his family could afford it. But suppose no trouble shooter had been enlisted, or no means of psychiatric help had been available? Would not John have sunk from failure into ruin? And would not the guilt for the tragedy have rested with school and college and the old notion that "bright students can take care of themselves"?

Who knows how many John Scotts we have on our campuses? In any case is it likely that any of our unchallenged students could really be called mentally healthy?

Are not honors and other programs for superior students just as important as gymnasiums?

Is not the problem of teaching superior students at a superior level a common problem of all education, elementary, secondary, higher? Just when John Scott's mental illness began would be hard to determine. The contributing factors, though existing in the college, could be traced back also to the lower schools.

Neglected Purposes in Higher Education

The assistant to the President, University of Omaha (A.B., Drew; M.A., Columbia; Ph.D., Ohio State), who has taught languages in both high school and university, has been a Fulbright scholar in England, traveled in Europe, and obtained an excellent perspective of education and its problems, analyzes the current situation in higher education and points out some neglected purposes.

By JOHN E. HORNER

EXAMINATION of the existing curricular patterns in higher education reveals that the contemporary purposes of the higher learning in America fall into two general categories: the traditional and the experimental.

The traditional purposes in higher education emerge from an academic position which emphasizes the intellectual aspects of education. These purposes plead for a training of the mind with emphasis on a preparation for the "good life." The traditionalist is concerned with the advancement of knowledge, particularly through the study of the liberal arts. These traditional purposes are probably best described in the professional writings of such educators as Robert M. Hutchins, Nathan Pusey, Mortimer Alder, Scott Buchanan, Stringfellow Barr, and Gilbert Highet.

The purposes in higher education, as outlined by the experimental position, include the practical and functional approaches where the status quo in education is challenged, and a strong plea for meeting the needs of individuals for life in a democracy is advocated. This position emphasizes the importance of science and its method. It also urges the marriage of democracy and education. For the experimentalist, education becomes a problem of life adjustment with vocationalism and specialization playing prominent roles. The experimental purposes have been strongly presented by such educational leaders as John Dewey, Boyd Bode, Sidney Hook, and Max Otto.

If we are honest with ourselves as we observe the traditional and the experimental purposes at work in our institutions of higher learning, we see that very often contact between the two results in open conflict. The campus of a modern university sometimes becomes an arena for internecine warfare between the traditional and experimental. Occasionally, this warfare is subtle and is carried on in a sophisticated manner, but at other times it results in hand-to-hand combat without regard to academic courtesy or protocol. Barbaric carnage occurs in the academic amphitheater. It is herewith urged that we appraise the contemporary conflict between the experimental and traditional purposes in higher education and observe whether such conflict is necessary in this day and age. Perhaps we had to come through a struggle, but now, at the midpoint in the 20th Century, the educational world is ready for a more vigorous cross-fertilization of the traditional and the experimental purposes. No longer can they remain at "logger-heads." The world in which we live demands a cooperative endeavor on the part of both factions.

A PLEA for a cross-fertilization of the experimental and the traditional purposes is a plea for higher education to grow from boyhood to manhood. There is little doubt that traditional factions will continue to oppose progressive factions in intellectual war. Nor is there doubt that the liberal university will persist in being a battleground for individual and collective academic conflicts. But some of the problems which beset the leadership in American higher education today are of such magnitude that in the solution of the problems academic factions must be willing to rise above parochial and vested interests. Life in an atomic and hydrogen age precipitates problems of an intellectual, social, and cultural character that demand for their solution requires the combined resources of the experimental and traditional.

There is certainly little doubt that science and related disciplines have dominated most curricula in most colleges and universities in recent years. The classics, the humanities, and the liberal arts in general have been removed to the background. The empirical sciences have been emphasized to such an extent that education has been made the handmaiden of any contemporary movement in society, no matter how superficial. It seems both necessary and unnecessary to state that science with its method has done much to advance societal welfare and the cause of humanity. It has produced what we commonly call our technocratic

society. This technocratic society has become synonymous with American progress. Our educational systems have been able to produce the greatest builders of bridges, the best extractors of gall bladders, and the finest petroleum seekers in the world. Such developments have been caused, in part, by the fruition of the experimental purposes in education. Our technocratic advance and specialization and vocationalism in education are inextricably related in this developmental process. However, it behooves the leadership in American higher education to examine the exact nature of its product in the mid-20th Century. What does history demand now? Certainly the experimental purposes in education are necessary, but the question is to know the exact significance of technocracy for the human animal and not to transform technocracy into the supreme wisdom and rule of human transactions nor to change means into ends. Science and technocracy have become gods. They have become objects of adulation as well as objects of utilization. When such characteristics become indelibly fixed in the matrix of human existence, they tend to force the simple human traits to disappear. Jacques Maritain makes a similar observation when he considers the great danger to contemporary education:

> . . . I mean the danger of an education which would aim not at making man thoroughly human but making him merely into an organ of a technocratic society. . . [1]

Certainly a relatively keen analysis of higher education reveals that one of the neglected purposes in higher education is the failure to bring about the cross-fertilization of the traditional and the experimental with an equitable balance in the promotion of academic disciplines.

If we are convinced that cross-fertilization of the traditional and experimental purposes is desirable, how then can it be accomplished? Is the cross-fertilization brought about by deemphasizing the experimental purposes in education? Certainly not. Cross-fertilization can best take place through the constant vigilance on the part of educational leaders to insure that in academic curricula the strangest of modern phenomena is not produced, an anti-intellectual university composed of specialists. Our educational program not only should supply our young people with the academic materials to build a technocratic society but it should also provide the academic materials for living in that technocratic society and for coping with it. The suggestion is made that our current higher education is neglecting this function which should be a primary purpose of higher education. Samuel B. Gould, in an interesting article in the March 1957 issue of the magazine *Think*, points out that our whole educative process in this day and age is based on the theory of "enabling" rather than "ennobling." Primarily, our educational programs provide the means for enabling the boy or girl to acquire certain techniques which will be of material value throughout life. Gould reflects that "it does not often enough develop the mind as an active and creative instrument, ennobling to the individual and his civilization." Alfred North Whitehead, the eminent British philosopher and mathematician, addresses this point when he describes the education of American youth. Whitehead remarks that the first twelve years or so of life are exploratory in character, where the child asks a never-ending series of questions which always begin with the word "Why?" The second phase of this education involves the acquisition of facts and knowledge which are put in systematic order. This phase corresponds to secondary education. At this juncture a limiting process begins. Boundaries, limitations, and restrictions begin to appear. More advanced tools of knowledge are acquired. Following this latter phase is a next step which includes a more sophisticated program in higher education. Although there is some freedom in this advanced learning, general ideas are still developed under control of higher, refined techniques. Whitehead suggests that the tragedy of American education appears to be that the initial sense of wonder and the urge to explore, so characteristic in the child, are lost in the secondary school and are rarely rediscovered during the years of higher education. What starts out in the child as true education dissipates into technical specialization.

PERHAPS it is an "old chestnut" to suggest that a renaissance of liberal studies is what is needed to bring about the afore-mentioned cross-fertilization but this is what is urged and declared as an imperative for the leadership in higher education. Very often, confusion reigns when terms such as liberal studies, liberal education, and general education are mentioned. Liberal studies are herein interpreted simply as the intellectual consideration of concepts, cultures, and ideas. It should be added that the plea for a renaissance of the study of concepts, cultures, and ideas should not be regarded as an effort to stifle sci-

[1] Jacques Maritain, *Education at the Crossroads* (Yale University Press, New York, 1943), p. 113.

ence, which is one of the liberal studies. Rather, the promotion of liberal studies should be regarded as an effort to assist men to take their places more readily in a technocratic society produced by the world of science. Certainly the rapid changes in engineering curricula in recent years indicate the concern by forward-looking scientific men for the necessity of curricular balance. The engineering schools of Johns Hopkins, Yale, Massachusetts Institute of Technology, and many others, both private and public, are now demanding a strong liberal studies program before entrance into engineering studies. In fact, some of these same institutions are devising coordinate programs with liberal arts colleges, one of the outstanding of which is the Wooster College and the Massachusetts Institute of Technology program. These programs are concrete examples of what can be done in bringing technological studies and liberal studies into proper balance.

As higher education plots its course through the Twentieth Century, it is becoming increasingly evident that the educational world is recognizing the practicality of liberal studies. There is a movement away from the feeling that liberal studies are merely the icing on the cake. They are and must be regarded as important ingredients of the educational cake. And as the batter for the cake is mixed, more than modest portions of liberal studies must be "folded in." The *Harvard Report* states very succinctly the value of liberal studies in bringing about the equitable balance between the experimental and the traditional purposes in education. In appraising the place of general education in university curricula, the *Report* reads:

> Education can therefore be wholly devoted neither to tradition nor to experiment, neither to the belief that the ideal in itself is enough nor to the view that means are valuable apart from the ideal. It must uphold at the same time tradition and experiment, the ideal and the means, subserving, like our culture itself, change without commitment.[2]

Let us now move to a third and final "neglected" purpose of higher education. This purpose concerns the limits and restrictions placed on our educational programs. As we go about our daily tasks in higher education, we sometimes build walls of parochialism which limit our vision and restrict the development of the total educational experience. In pursuing these daily tasks, we sometimes fail to perceive the power drive of an international scope which is going on about us. This power drive involves a struggle for men's minds; more directly, the struggle concerns the encounter between democracy and the many "isms," a struggle between East and West—couched in darker terms, a struggle between freedom and subjugation. But what has the leadership in higher education done to prepare students to participate in this power struggle? For, as Toynbee says, "the present encounter between the world and the West is now moving off the technological plane onto the spiritual plane."[3] Implicit in Toynbee's statement is that this power struggle will not be decided solely with guns and bombs but with weapons of mind and spirit. The struggle of minds, spirits, and loyalties is already World War III.

Is it conceivable or possible that the leadership in American higher education cares not what the nature of the decision in this power struggle will be? Can colleges and universities stand idly by, almost completely oblivious to international events, or is it the duty of colleges and universities to participate actively in whatever is the supreme moral obligation of the age?

It is suggested that the modern university cannot stand idly by oblivious to external happenings of an international scope. It must participate actively in whatever is the supreme moral obligation of the age. To this end, it is urged that one of the major purposes of higher education should be the development of global-mindedness in the youth of today. The technocratic society, which we have mentioned earlier, has produced the methods and devices which have reduced the size of the world. The prospect of One World, geographically speaking, is no longer a concept for the future. It is a reality which man presently faces. Young people of today in our institutions of higher education must not only concern themselves with the culture of our own nation, but they also must concern themselves with the cultures of other nations in this One World in which we live. To accomplish this, the content of our university educational programs must change in character. Compare, if you will, university catalogs of twenty years ago with those published in 1957. The basic content of these catalogs is relatively the same. In our era, now and then, courses in the Russian or Chinese language appear in these catalogs—occasionally, some institutions teach Japanese history—and less fre-

[2] Harvard University, *General Education in a Free Society* (Harvard University Press, Cambridge, 1945), p. 51.
[3] Arnold Toynbee, *The World and the West* (Oxford University Press, New York, 1953), p. 16.

quently, contemporary colleges and universities offer survey courses in oriental cultures. In general, such offerings are minimal in character, but educational patterns predicated on current global relationships and concepts must eventually find their way into the modern university. Ralph Barton Perry urges this development when he writes:

> If education is to qualify men to live in a global society and contribute to its development in the years to come, the content of education must be correspondingly extended. In short, it must cultivate global-mindedness.[4]

Theodore Greene presents the same thesis in these words:

> The social purposes of education must be to prepare young men and women for responsibility and cooperative participation in all the overlapping social groups which constitute the struggle of our complex society—in the family, in a business or position, in the local community, in the nation, and in what is now hopefully called the family of nations.[5]

Perhaps this plea for global-mindedness in education is not novel, but its degree of emphasis for American higher education is new. Foreign students study American culture from language to history, from geography to social mores, and from politics to religion. American undergraduates know nothing or next to nothing about the culture, the history, the problems, the language and, above all, the needs of the peoples and cultures with which American intercourse is bound to increase constantly. If the United States desires to continue its focal position as a world power in global relationships, its educational system can no longer ignore external cultures and civilizations as it has done hitherto, except at rarefied scholarly levels. Eastern universities consistently teach the study of the West. We, in our stupidity, do not deem the East worth studying. To maintain our place at the head of the family of nations requires more than signing of treaties, the export of foreign aid, or the exchange of student ambassadors. It requires a thorough understanding of the cultures, concepts, and ideas of those people with whom we have contact. Thus, a strong reappraisal of the purposes of higher education is needed so that an educational program can be evolved in which the concept of global-mindedness plays a very important part in this struggle for men's minds.

As the higher learning in America reviews the purposes which it is currently neglecting, it is urged that thoughtful consideration be given to the advancement of a more vigorous cross-fertilization of the traditional and experimental purposes. It is thought that the desired cross-fertilization can best be precipitated through a renaissance of liberal studies in which man will not only find his rightful place in a world of specialization but also he will be able to acquire a meaningful understanding of the dynamic society and of the cosmic universe around him. It is also advocated that, as institutions of higher education consider problems of curricular development, academic patterns based on global-mindedness will come to occupy positions of prominence so that our youth may participate in the solution of global problems with confidence and competence.

[4] Ralph B. Perry, *Realms of Value* (Harvard University Press, Cambridge, 1954), p. 436.
[5] Theodore Greene, *Liberal Education Reconsidered* (Harvard University Press, Cambridge, 1954), p. 33.

Delayed-Action Bomb

"All true education is a delayed action bomb, assembled in the classroom for explosion at a later date."

CLIFTON FADIMAN in Holiday, October 1958.

Editorial—

The Game of Grades

IF CREDITS ARE THE COINAGE of Academia, grades are the stamp that sets their value. A credit bearing grade A has highest value, a credit with F none at all. A professor who advocates the abolition of grades, even citing successful experience in operating without them, arouses alarm; he would debase the currency. Of course, it already is debased. A college senior declined membership in an honor society, saying, "My grades do not stand for anything for which I should be honored. They represent only my ability to parrot back what my teachers told us in class."

Faculty and students alike are aware of the unreliability of grades. Grades from one department may represent better work than the same grades from another department. A grade of A from one teacher may really equal a grade of C from another. Teachers hold very different ideas and employ very divergent systems in assigning grades. Some never fail a student, while some on the average fail one in four.

Different teachers will score a paper or examination very differently. The same teacher will score the same thing differently at different times. He may be more or less exacting at the beginning or at the end of a paper or at the top or the bottom of a pile. Though grades appear orderly and uniform, and though on them depend many momentous aspects of a student's career, they do not bear analysis. "When the guesses of different instructors are combined to give an average, we have much the same result as though we added pears and apples, multiplied by doorknobs, and divided by peanuts." The elements of truth in this satire detract seriously from the demigod known on campuses as the grade-point average.

As professionals, supposedly qualified not only as specialists but also as teaching operatives, we need to study our grades and grading. What if their erratic character is a symptom of confused purposes and wrong practices in our teaching itself? Perhaps we need to analyze our teaching in all its aspects. If we determine clearly what we are trying to teach and why, what outcomes, broadly and thoroughly conceived, we desire, we may come better prepared to the task of grading.

Grading is, in fact, inescapable in teaching. We do more of it than we realize. What we commonly call grades are assigned to outcomes, but we practice evaluation in respect to aims and procedures as well. Whenever we make choices or decisions in respect to teaching goals or teaching procedures, we automatically place a stamp of approval on what we select or of disapproval on what we reject. We give a grade to a goal or a method, whether we realize it or not. Grades of this kind are covert, while those that go to the registrar are overt.

The fortuitous character of grades and grading casts professional discredit upon us. If grading were a game, we might expect and accept a large element of chance. Casting dice and dealing cards are common in games, and chance plays a large part. But in games of high order skill plays a large part as well. And certainly the scoring of the outcomes of teaching-learning should not be a game; the issues are too grave for that. The scores that students get—the grades we give—should depend upon a minimum of chance and a maximum of skill. Do we as teachers simply lack skill?

If we realize that teaching is a matter of evaluation from beginning to end, we may more readily accept the role of grade-giver at the end of a term since as teachers we are practiced evaluators. We have means of determining what students—at beginning of a course, during it, and at its end—have achieved. Tests and examinations are controlled means of diagnosing the teaching-learning process. Other instruments of evaluation also are useful. Evaluation aids can reveal what we need to teach and how well what has been taught has been learned. If we perform well our part as evaluators, we not only will have valid criteria for assigning grades but will have the competence required for the task.

What Do College Grades Mean?

A Survey of Practices at Four Institutions

Here is a penetrating discussion of grades and grading, neatly presented in a few paragraphs. The author (Ph.D., Chicago) was for five years a faculty member in humanities at Chicago and one of the college examiners. Since 1950 he has been at San Francisco State. He was a Faculty Fellow under the Fund for the Advancement of Education, Fulbright Lecturer in Berlin, has served on WCA accreditation committees and the National Selection Committee for Fulbright awards, and is currently a member of Committee on College Teaching of the American Council on Education.

By JOSEPH AXELROD

IN GRADING A STUDENT, the teacher certifies (1) that the student has pursued a particular course of study, and (2) that this pursuit has been of a certain quality or "grade."

I propose to analyze the standards (or criteria) by which such certification is commonly made, to present examples of difficulties that arise as a consequence of the conflicting criteria, and to suggest two directions of solution for the grading problem.

▶ A few years ago, I had an opportunity to study problems in evaluation in the undergraduate programs of a half dozen colleges. The scope of my project did not originally include a study of the criteria commonly used for determining student grades. At the first two of the institutions, the responsibility of grading students (for purposes of certification) did not rest with individual instructors, and my interest in this problem was not aroused. At two other institutions, however, I quickly became aware of the wide variation among the criteria used by instructors in determining the grades they gave their students.

At the first two institutions, the criterion was clear:

1) Level of achievement of the course goals at the time the student took the final examination: mastery of informational knowledge, performance level on intellectual and other skills, etc.

Comment: No other factors played the slightest role, such as how the student looked or spoke (unless, of course, these were attainments being measured); how hard the student had studied; how little he had known to begin with, or how much; the conditions against which he had fought to attain the knowledge he had; the needs occasioned by his growth into a mature individual. The single criterion was the *level* of achievement at the *end* of the course.

At the other institutions, in all but a few cases, the primary criterion for grading students appeared to me to be the student's end-of-semester achievement level (usually not very adequately estimated) judged in the light of some *other* factor. I found the following criterion quite common:

2) Achievement level at the end of the course, judged in the light of the student's potential capacity.

Comment: "This student did very well indeed, but I gave her a C because she was not working up to capacity," is the common way in which this criterion is expressed. On the basis of their experience, many college teachers feel they are able to judge what the achievement level of a given student *would* be, if the expected time, effort, and energy were expended on course work. Others, not able to make this judgment, depend on more tangible demonstration. Hence, evidence that the student has spent time, effort, and energy in studying for the course often becomes very important to the instructor who uses this criterion.

3) Achievement level at the end of the course, judged in the light of the student's achievement level at the beginning of the course.

The student who receives an A is one who has made "great progress"; the one who receives a D or F has made "little progress."

4) Achievement at the end of the course, judged in the light of financial and other physical conditions in the student's life that make it easy or difficult for him to do his course work.

Example: David N. was potentially an A student. He and Mrs. N. were both working part time—at different hours, to save baby-sitting fees. N's health had been impaired by his months in Korea. Everyone agreed that he was an example of courage and fortitude. His achievement level at the end of the course was just above the mid-C line. He obviously was not able to spend enough time on the course; his progress was not very great. But, given his conditions, it is clear that he did an outstanding job in the course. His instructor felt justified in giving him a B rather than a C as a course grade.

5) Achievement level at the end of the course, judged in the light of the psychological factors which hindered or favored the student's achievement, and in the light of his future development as a better student and a more mature individual.

Comment: Some instructors, aware of the tremendous power of grades in affecting student behavior, told me of their attempts to explore motivational uses beyond the simple reward-punishment factor. For example, in one college, Professor K. called my attention to a brilliant teaching assistant who, a few years earlier, had been in a class of K.'s, potentially an A student but doing mid-B work. K. had discovered that this was the case also in all the student's other courses and, after further investigation, had concluded that the level of the student's work was being brought down by his distorted view of his own potentialities. K. was persuaded that if the student could receive an A grade, he would be helped to see himself as capable of A work and in subsequent courses would be more likely to reach the A level. K. had therefore decided to give him an A.[1]

Aside from differences of opinion about the importance of each of the foregoing criteria which I found among faculty members, there were vast differences of opinion as to whether the same criteria should be used by various instructors in the same department, in the same course, or even by the same instructor in a single class. I found no consensus on these questions.

▶ One of the institutions which I studied was plagued by the problem of "low standards." The evidence to which faculty members pointed to demonstrate the low standards consisted of course grade statistics—the preponderance of A's and B's and the smaller proportion of D's and F's.

I was able to study the grading practices of some twenty instructors who were allegedly not "hard" enough on their students. Space does not permit a long recital of cases, but the following five will be illustrative.

Example 1: Dr. Adams, who could not collect evidence

Dr. Adams did not have, by the end of the semester, the kinds of evidence he needed in order to judge what grades his students should receive. He actually (in my frank opinion) did not seem to know what kinds of evidence were needed or how to get them. In addition, he apparently could not face a complaining student and be asked to justify a low grade—since, in fact, there was nothing definite to which he would be able to point. He relieved both his anxiety about not knowing how to evaluate his students adequately, and his anxiety about the possibility of facing a complaining student, by giving grades high enough so that no student would feel he had been undergraded.

Example 2: Dr. Bates, who was inefficient

The rush at the end of the semester was always so great that Dr. Bates found he did not have adequate time to read carefully final examinations, term papers, late papers, etc. Most of his students fell into a 2-grade range in his first attempt to assign grades; e.g., Appleman was roughly in the B-C range, but Dr. Bates did not have time to examine the evidence in order to determine whether Appleman should get a B or a C. He solved the problem by giving Appleman the benefit of the doubt.

Essentially Dr. Bates' problem arose out of inefficiency. It was not lack of evidence (as in the case of Dr. Adams) but lack of time to appraise adequately the pieces of evidence he did have, for he accumulated these mainly at the end of the semester.

Example 3: Dr. Davis, for whom an F signified his own failure

Dr. Davis worked hard with his D and F students outside of class. By the end of a semester, he very often would have no students who remained at the D or F achievement level. (Mr. Davis used standardized tests, which are available in his field, to appraise his students' achievement.) He considered it a mark of his own success as a teacher if he did not have to give any F's. He told me that every F he gave meant that he had failed in his responsibility.

Example 4: Dr. Ellison, who could not disappoint those he had encouraged

Dr. Ellison found he succeeded in getting his poorer students to expend greater efforts in their work by praising them. He disagreed with his colleagues who attempted to motivate poor students by telling them how poor their work was and threatening to fail them. But Dr. Elison found that without really intending to do so, he led students to expect better grades than he thought they actually deserved. When he came to making out grades for his students, he felt he could not in all justice give them the grades he thought they deserved.

He solved the problem by giving them grades somewhere between the ones he had led them to expect they would get and those he thought they really deserved.

He told me that this process occurs regularly.

Example 5: Dr. Haley, who urged his poorer students to drop out

Dr. Haley did not like to give D's and F's. After five or six weeks of a semester passed, he arranged conferences with his poorest students and told them they would probably fail. He urged a reduction of their course load and suggested that they drop his course.

(Note: At the time of this study of Dr. Haley's institution, if a student was doing passing work at the time of official withdrawal from a course, he did not receive an F but a W as his course grade.)

Since students preferred a W to an F or even a D, Dr. Haley had few low grades on his record sheets.

[1] Subsequent events, according to K., justified this decision. Incidentally, for those readers who might suppose that K. was certainly in a psychology department, let me report that he taught philosophy. In discussing the case here reported, Professor K. quoted for me the following passage from *Dialogues of Alfred North Whitehead* (ed., Lucien Price, Boston: Little Brown, 1954, p. 46):

"I am profoundly suspicious of the 'A'-man. He can say back what you want to hear in an examination, and . . . you must give him his A if he says it back; but the ability, not to say the willingness, to give you back what is expected of him argues a certain shallowness and superficiality. Your 'B'-man may be a bit muddle-headed, but muddle-headedness is a condition precedent to independent creative thought in its first stage. Of course it may get no farther than muddle-headedness. But when my colleagues chaff me for giving more A's than they are willing to do and tax me with tenderheartedness, I reflect that I would rather not have it on my head that I was the one who discouraged an incipient talent."

In order to meet the problem of the disproportionate number of high grades and to "raise standards" in the institution, a faculty committee was set up. The committee introduced the practice of publishing the grade distributions (percentages of students who received each letter grade) for each department at the end of each semester. Faculty members from departments that were "out of line" presumably lost status with colleagues in other departments.

Furthermore, in a number of departments, the grade distributions for each instructor were mimeographed and distributed at a departmental meeting. This appeared to be accepted as regular practice. At one departmental meeting which I attended, in which there was a brief discussion accompanying the distribution of these lists, several faculty members tried to "explain" why their grades were not lower.

Some faculty members expressed resentment at "being tyrannized by a faculty committee," as they put it, but could not deny the statistical evidence that, as a result of committee pressure, grades throughout the institution had moved downward. Even committee members, however, were not so naive as to suppose that as grades had moved downward, "standards" had automatically moved upward, and that the total problem therefore no longer existed.

Indeed, there seemed to be general recognition that while the labels had changed, the process of collecting evidence about student achievement and of interpreting that evidence had been in no way affected. The good Dr. Adams (of *Example 1)* was still unable to gather the evaluative evidence he needed in order to give grades; but, on the basis of the inadequate evidence he had, he did bring himself, under committee pressure, to give more D's than he had given during the preceding semester. Dr. Bates (of *Example 2)* was as inefficient as ever; he still could not decide whether Appleman should get a B or a C; but, under committee pressure, he now solved such problems by *not* giving the student the benefit of the doubt. Dr. Davis (of *Example 3)* remained unchanged and adamant; in his ministerial voice he continued to assert that when he occasionally gave an F, it was because *he* had failed. The problem disturbing Dr. Ellison (of *Example 4)* before the committee had been formed continued to plague him; he still had not learned how to grade students in accordance with their actual achievement. But the behavior of Dr. Haley (of *Example 5)* was seriously affected by the committee. Before the committee had done its job, Dr. Haley had encouraged poor students to drop his course and take the grade of W. Later, however, he changed his policy and encouraged them to remain, so that his grade record might show some D's and F's.

At the time my own observation of grading practices at this institution came to a close, members of the committee told me that only the "quantitative, less difficult, aspect of the problem" had been attacked, and that committee work was actually moving into its more important phase.

► According to faculty opinion at the institutions which I surveyed, the solution seemed to lie in one of two directions: either (1) college instructors should be relieved of the task of appraising achievement in their own students for purposes of certification, and concentrate on *teaching,*[2] or (2) some kind of in-service training program ("faculty seminar") should be introduced to help college instructors learn from visiting specialists in evaluation the best ways of appraising achievement level in given subject-matter areas. (A few brave souls favored the abolition of grades altogether, but conceded that they were needed for "official" records—for transfer purposes, etc.)

To most of the faculty with whom I spoke, neither of these solutions seemed possible of attainment in the foreseeable future in most American colleges and universities.

[2] The advantages most often put forward by adherents or proponents of this solution seemed to me to fall under these three headings: (1) Such a system would relieve the individual instructor of the task of constructing his own tests and giving his own grades—a task which, to be effectively performed, requires an amount of time and the possession of skills and techniques which, on the whole, college instructors are unwilling to give and do not possess. (2) It would permit a more accurate appraisal of student achievement at the time the test is given; thus, it would permit a more accurate appraisal of student progress from one "centralized" test to the next, and in addition it would enable instructors to have a clearer idea of the effectiveness of their instruction. (3) It would alleviate (or eliminate entirely) the present variation in the criteria for grading students, and hence would avoid possible injustices by grading all students in the same course—no matter which semester or instructor—on the basis of uniform standards.

Improving Testing and Marking Practices

Here is an article which does not pretend to cover the whole subject of testing and grading, but assumes that if instructors can be impressed with the desirability of improvement serious weaknesses in teaching can be lessened. The author (B.A., Cornell; B.L.S., George Washington; M.Ed., D.Ed., Oregon) has held faculty positions at Phillips and Baylor universities, and (at present) Lewis and Clark College where he is librarian and professor of education. He has served in the Library of Congress, is author of "Gutenberg and the Invention of Printing" and other works, and has been a contributor to educational journals.

By LAURENCE ELLIOTT TOMLINSON

BECAUSE ACADEMIC COMPETITION is assuming greater importance, scientific methods are becoming an essential factor in effective teaching. This article seeks to call attention to weaknesses and variations now prevalent in college in making evaluations of student achievement and, more important, to provide suggestions which, if followed, will result in a more scientific methodology in achievement measurement.

Administrators, instructors, and students may overemphasize grades, but as long as they are used as the principal means of evaluating student achievement, they should be determined as objectively as possible. The day to day marking practices of individual instructors should not differ widely, nor should there be much variance in practice among different instructors.

Grades today, more than ever in the past, are setting the limits of student possibilities in regard to college entrance, scholarships, fellowships, graduate study, and even after-college employment. Hence, it is incumbent upon all educators to recognize the seriousness of the problem.

VARIATIONS IN MARKING

Some instructors believe that the essay type of test alone is suitable to their needs. The opportunity of providing the student a chance to organize his thoughts, and to express them at length and in detail, is considered to be of utmost importance. While it is possible to construct essay type tests so that they are both valid and reliable, few of them are. Furthermore, the marking of such test papers is apt to be quite subjective, inconsistent, and either too lenient or too strict. A few suggestions concerning this type of test are given below.

Whenever the marking practice places principal reliance upon subjective evaluation, many unintentional abuses are involved. Studies have shown that, on the average, both men and women instructors tend to give higher marks to female students than to male students for the same quality of work. Often it is found that some departments give higher marks than other departments. This has been found to be true especially in comparing such departments as those of music, art, and physical education with those of chemistry, physics, biology, and foreign languages. Furthermore, experimental studies have shown that individual instructors vary widely in the repeated marking of identical papers. It has been found that when instructors approach the bottom of a stack of papers, they tend to be more lenient in marking than when they are starting a stack.

Some teachers think that using the normal curve is a fair basis for assigning marks. This practice is followed in spite of the fact that the actual distribution of scores in a class does not often follow a normal curve. Furthermore, this practice does not take into consideration the possibility that all or most members of the class may be doing exceptionally good or exceptionally poor work in comparison with similar classes of previous years.

Occasionally, instructors will give lower marks for otherwise adequate answers in cases of poor penmanship, poor spelling, or short answers. Usually, little attention is given to the weighting of essay type questions, when frequently some may be considerably more difficult than others. Some instructors provide frequent tests and assignments which are marked and which are considered in the final course mark, while others rely very heavily upon the final examination. At times, instructors consider to some degree the progress of individual students, irrespective of their competitive standing in the class. At other times no attention is paid to individual progress, which may be below or above the average of the class in comparative achievement. This latter type of varia-

tion may be justified on the basis of the instructor's educational philosophy.

The variations cited above are common in every educational institution where the products of students are marked and where grades are given. It is not assumed that these variations can all be eliminated, but it is believed that if instructors can be made more aware of their nature and consequences, *if instructors can be impressed with the desirability of the improvement of educational methods,* then serious weaknesses in education can be lessened.

Improvement of Marking

A fundamental requisite for effective marking is the setting up of course objectives. Before the instructor begins a course, he should list all of the various objectives that he believes his students should attain by the end of the semester. These objectives at first may be stated in general terms, but later they should be reduced to very specific items, and expressed in the form of student behavior. For example, the instructor must seek evidence that the student *understands* principles, facts, and concepts; that he *expresses* himself in an intelligent manner within the subject; that he *demonstrates* the attitudes, appreciations, interests, and ideals which are both essentials and by-products of successful mastery of a subject. Once these specific and detailed objectives are set up for each unit or important segment of a course, then, and not until then, is the instructor ready to formulate tests and other exercises to determine in what ways and to what extent each student has successfully achieved.

It is generally conceded that effective instruction necessitates provision of frequent student exercises. Active learning in oral or written reports, participation in panel discussions or committee investigations, and answering quizzes and tests are much more effective than the more passive learning in listening to lectures, and performing reading assignments. These various activities encourage the student to think more, to review, to summarize, and to apply what he is learning. Such activities enable the instructor to use various devices for evaluating student progress, thus providing ampler evidence that students are on their way to the attainment of the course objectives. The greater the variety and frequency of such exercises, the more interested the students should be, and the more the instructor should know about each student. The size and academic level of the class as well as the nature of the course will determine, to some extent, the type and frequency of such class activities.

When tests are given, their worth as measuring instruments of student achievement depends upon their validity and reliability. If a test is valid, it adequately covers that portion of the course on which the students are tested. It is an *adequate* representative sampling in terms of questions which the students readily understand. It separates the students who have learned what they should have learned from those who have not. If a test is reliable, it is one which is effective *consistently* with class after class in determining student achievement. With other factors equal, those tests which require the greatest number of specific responses from students will be the more valid and reliable. That does not necessarily mean, however, that the more time-consuming a test is, the more valid and reliable it will be.

The validity of a test depends very largely upon the validity of each question. This can be estimated by determining what per cent of the best fourth of a class answers a question correctly, compared to the per cent of the poorest fourth of the class which answers correctly. If ninety-six percent of the best fourth answers correctly, while only sixteen percent of the poorest fourth answers correctly, then it may be said that the index of discrimination for that question is ninety-six minus sixteen, or eighty. On the other hand, if ninety-eight percent of the best fourth answers correctly and eighty-eight percent of the poorest fourth answers correctly, then the index of discrimination for the question would be only ten. This would indicate that in the first case the question may be quite valid, while in the second case the question does not have discriminatory value to justify its inclusion in a test.

Table 1
Analysis of Discriminatory Power of Test Items

Item number	Per cent correct responses of upper fourth	Per cent correct responses of lowest fourth	Index of discriminatory power
1	98	88	10
2	90	30	60
3	56	54	2
4	96	16	80
5	4	0	4
6	60	10	50
7	40	60	–20

It is necessary, of course, for the instructor to establish as early as possible a dependable record of the members of his class, so that he can group them into fourths for this purpose. If an instruc-

tor will experiment with his test questions in this way, and apply them to several different classes in the same course, he may be able in time to develop admirably valid and reliable tests.

Tests will provide more effective results if instructors will not only inform students in advance as to whether a test will be an objective or an essay test, but also give them some instruction on how to prepare for the test. If a test is to be an objective test, and if it is to emphasize facts, names, dates, formulas, persons, etc., the students should be informed of this. Also, it is well to advise students not to make wild guesses, and not to spend too much time on questions about which they are uncertain. It is also well to advise students to use caution in changing their answers, once they have been carefully selected.

If the test is of the essay type, emphasizing principles, concepts, opinions, arguments, descriptions, evaluations, methods, etc., the student should be informed in advance concerning this. Moreover, it would be well to permit students in taking this kind of test to have some choice of questions, and to let them answer first those questions which they believe they can answer best. The suggestion is often made that students outline their answers briefly in the margin before they write.

In marking test papers, reports, and other exercises, the instructor should consider the comparative achievement of his class in relation to the typical class that he has had in his course. If a class is an exceptionally good one, he would be justified in giving a greater percentage of high marks and a smaller percentage of low marks. Likewise, if a class is unusually poor, the percentage of high marks would be less, while that of low marks would be greater. After a few years of experience, an instructor who has established good communication with his class members can fairly well determine the nature of a class in this respect. However, comparison with the actual work of previous classes would be desirable. In compliance with these suggestions, it is observed that an instructor cannot set in advance the percentages he will have in each classification of marks.

It is suggested that an instructor should never follow a normal curve in assigning marks. Rather, in his distribution of class scores, he should follow the curve that he actually has. In other words, it is more scientific to determine letter grades on the basis of standard deviation units. A simple method of doing this is described later.

The final consideration that some instructors wish to make before coming to a decision on a midterm or course grade is the improvement in achievement of individual students. While it is true that most instructors, especially on the college level, will assign semester or term marks on the sole basis of competitive academic achievement, there are occasions when it is desirable to take into account the improvement of individual students. It is doubtful that bright students should always receive highest grades if they try only to surpass other members of the class, rather than their own previous accomplishments. Likewise, it is doubtful that slow students should always be given lowest grades, if it is clearly evident that they have worked diligently, and actually have improved greatly beyond their previous records. Probably the accident of a bright student's membership in a dull class, or of a dull student's membership in a bright class, should not *always* be the sole determinant of highest or lowest marks.

Accumulation of Points

One satisfactory method of keeping a record of the work done by the different students in a class is to provide a numerical mark for every exercise and test that each student has completed. In assigning such numerical marks, the instructor not only can weight the importance of the test or exercise, but he also can indicate the competitive value of the work done. For example, for the highest mark for a short written report for one day's assignment, a mark of 4 may be recorded. For a paper of another student for the same assignment, but one which lacks the excellence of the first, a mark of 3 may be given.

For an A grade in a midterm test the instructor might give a numerical mark of 12. For an A grade for the final examination or a term paper, the instructor might select a numerical mark between 15 and 20. At two or three times during the semester the instructor can add up these "points" to determine the relative accomplishment of each student on the basis of his accumulation.

This system provides for a recording of the amount of work a student completes as well as the evaluation of quality. The total accomplishment of each student is indicated by the sum total of these numerical marks. At the end of the semester the sum of points for each student can be

converted into letter grades in the same manner that test scores may be converted, as described later.

Type and Frequency of Tests

Essay tests can be made valid if there are enough questions, if the required answers are definite and fairly short, and if they provide a representative sampling of all the material on which students expect to be tested. Both the validity and the reliability of this type of test may be increased if the instructor sets up in advance a "key" for each answer, and then marks each answer as objectively as possible, irrespective of irrelevant factors such as spelling and grammatical expression. These deficiencies, however, should be called to the attention of the student. If the instructor wishes to give considerable emphasis to student expression, the best opportunity for this would be in the assignment of written reports rather than in a test.

Another factor of importance in essay tests is the weighting of the questions in accordance with their difficulty. This can be done on the basis of an index of discrimination, as mentioned previously.

Although it is often assumed that essay tests are easier to construct, their construction, if they are set up as recommended above, is often as difficult as that of objective tests. Moreover, as they are improved and made more valid according to the suggestions given, they begin to resemble objective tests of the completion type. With more experience in the attempt to construct improved tests, instructors frequently become convinced of the greater effectiveness of objective tests, as well as the much greater objectivity and ease in scoring.

Objective tests may be of the following types: completion, true-false, multiple choice, matching, and chronological or logical arrangement. Studies have shown that these different types rank in the order in which we have named them in regard to frequency of use as teacher made tests.

The completion type can be used to advantage in such subjects as mathematics, the natural and physical sciences, and other subjects that require retention of minute factual knowledge. The factor of guessing is reduced to a minimum in this type of test.

The true-false test is not as easy to construct as one is apt to think, since the statement must be definitely true or definitely false. If the test is to provide some flexibility in regard to opinion, then it should be changed to an agree-disagree test. One should avoid specific determiners in such words as "always," "never," "invariably," etc. An effort should be made to avoid providing a hint in one question which will influence the answer in another. A test of this type should approach one hundred questions in order to be reasonably valid or reliable. It can be used in almost any subject field. An important advantage is that it provides rapid, objective scoring.

The multiple choice test is the type used most frequently in such well known standardized tests as the National Teacher's Examination, and the Graduate Record Examination. Its principal value lies in the provision of an opportunity to reason and to select from different emphases or shades of opinion. The student is not as often affected by mental blocking in this test as he would be in a strictly recall test such as the completion.

For the college level, the multiple choice test should include five choices from which the student selects one. All of the ideas or statements among the five should be somewhat similar and superficially plausible. All statements should be in a positive form, and the placement of the correct choice should vary from question to question, with the least number of correct choices appearing in the fifth position. Care should be taken in making each possible choice of the same length as the others. No attempt should be made to confuse the student.

The matching test is well adapted to such subjects as literature, history, geography, and other subjects in which various items may be paired. There should be from six to fourteen items to be paired, with one list of items outnumbering the other by two or three.

Arrangement tests are of value in giving the student an opportunity to demonstrate his understanding of logical sequences, cause-effect relations, and chronological order. In this test the student is required to rearrange in proper order any given items by writing them in a vertical column parallel to the one presented him.

For factual questions of a recall type, the instructor should allow a minimum of one minute for three questions. For factual questions of a recognition type, one minute should be given for four questions. If the questions involve reasoning, one minute should be allowed for two of the recall type. For a reasoning-recognition question, the timing should provide one minute for three ques-

tions. In the more difficult subjects, and on the lower academic levels, more time should be provided.

Practices differ widely concerning the frequency of tests. It is probably better for an instructor to err in giving tests too frequently than not to give them often enough. The particular class situation, method of course presentation, number of assignments, and principal purpose of a test should determine the frequency.

Tests can be given not only to measure achievement, but also to stimulate interest and curiosity, to motivate retention, and when given at both the beginning and at the end of a unit, to determine actual individual progress.

Experimental studies have shown that if an instructor gives a five minute quiz at the end of an hour of lecture, the student remembers more, and for a longer period.

For the purpose of measuring achievement, it would be well to give a thirty to fifty minute test once every three or four weeks in a three hour semester course. It is suggested that the combined value of occasional tests throughout a semester should at least equal, and preferably exceed, the value of the final examination. The frequent tests should tend to stress the more isolated factual knowledge, while the final examination should tend to stress principles, concepts, and the application of the knowledge and skills acquired.

Scoring Objective Tests

Since the factor of chance, or guessing, can be important in most objective tests, it is generally recommended that the correction formula be used. It is of greatest value with objective questions that include only two or three choices from which to select a single answer. It may be stated as follows: The score corrected for guessing equals the number of right answers minus the number of wrong answers, the latter first being divided by the number of choices minus one. The symbolization is $S = R - \frac{W}{n-1}$. It is obvious that whenever the correction formula is used, the students should be instructed not to guess an answer, if they are completely uncertain.

There are two reasons why it may be a good practice to have students score papers in class immediately after completing a test. The first and better reason is that it provides an opportunity to the student to profit from his mistakes by correcting them in his thinking while he is most concerned about them. The second reason is that the practice avoids the time consuming work of scoring by the instructor.

The following procedure is recommended: Have the papers collected, and then redistribute them so that no student will mark his own paper. Ask the marking student to write his name at the bottom of the first page. Request the students to mark in ink. Give definite instructions for the marking of each type of test and for computing the total score. After this is completed, each student can receive his own paper for checking the scoring, and for raising questions about troublesome items. In educational psychology it is recognized that the greatest educational value of a test may lie in the learning responses of the student after an examination.

In some cases, it is desirable to be able to compare the scores of different tests, not only tests in one subject, but tests in different subjects. This comparison cannot be done effectively unless the raw scores are converted to standard (T) scores. This conversion can be accomplished easily by applying the formula, $T = 10\,\frac{(X-M)}{SD} + 50$. In this formula, "X" is any given raw score, "M" is the mean, and "SD" is the standard deviation. The mean may be obtained by adding all the scores by an adding machine and dividing by their number.

The SD may be approximated adequately by using a shortcut method. This method is to determine the average of the highest ten percent of the scores. Then determine the average of the lowest ten percent of the scores. Subtract the latter average from the former average, and then divide the remainder by 3.4. The result of this division will provide a workable estimate of the standard deviation. However, the reliability of this method is decreased when a class is small.

After raw scores of any test are converted to standard T-scores, it will be noticed that the mean will always be 50, and that very high scores will range upwards from 65, and very low scores will range downward from 35. In T-scores each 10 points in a score equals one standard deviation unit.

Changing Numerical Scores Into Letter Grades

A common practice of instructors in changing scores into letter grades is to invariably select the highest 7%, change them to A grades, select the

next highest 24%, give them B grades, determine the next highest 38%, give them C grades, select the next highest 24%, give them D grades, then give the lowest 7% F grades. If this practice is not adhered to strictly, then an arbitrary variation of this method is often used.

The unreasonableness of this practice has already been pointed out. Very seldom does the distribution of scores in any class follow a normal distribution curve. There are more scores above the mean than below, or there are more below the mean than above. Also, the mode may be above or below the mean. Frequently a distribution of scores may show a bimodal distribution. Under these circumstances it would be unwise and unfair to determine letter grades by the malpractice described above.

To be correct in the assignment of letter grades, they should be made to reflect the actual scattering of scores above and below the mean. If this is done, it is quite possible that there may be no A grades at all, or no B grades.

The suggested method of converting raw scores into letter grades is to determine the mean and the standard deviation of the distribution. This may be done easily as described in the preceding section. When the mean and the standard deviation have been obtained, then the letter grades may be determined as follows: The mean plus 1½ standard deviation equals the lowest A grade. The mean plus ½ standard deviation equals the lowest B grade. The mean minus ½ standard deviation equals the highest D grade. Finally, the mean minus 1½ standard deviation equals the highest F grade. The C grades are those between the lowest B grade and the highest D grade.

The result of this method may be that the instructor finds that he has too many high grades or too many low grades in comparing his class with his typical class for the particular course. At this point, and only at this point, should the instructor's own philosophy enter in. He can raise the letter grades by adjusting the mean downwards experimentally and applying the formula anew until he has the desired result. Likewise, he can lower the letter grades by adjusting the mean upwards. No matter how the mean is adjusted upwards or downwards, the distribution of letter grades will be representative of the actual scattering of the test scores.

If a test has been given several times in the recent past to previous classes, it would be well to compute the mean score for the combined classes and to use it in the formula described. This would then tend to take into consideration the typical class for the course. It is obvious that the method cannot be used on extremely small classes unless a backlog of scores of many previous classes has been maintained.

ILLUSTRATION I
CONVERSION OF FINAL EXAMINATION SCORES INTO LETTER GRADES

Scores	
88	Av. of Highest 10% of Scores = 87
87	
86	Av. of Lowest 10% of Scores = 41
86	
85	87 – 41 = 14 = Approximate Standard Deviation
84	
84	3.4
77	
77	
77	
76	Adjusted mean plus 1½ SD = Lowest A Grade Etc.
75	
69	
68	
68	
66	
66	85 – A Grade
63	
60	71 – 84 B Grade
59	
58	58 – 70 C Grade
55	
54	44 – 57 D Grade
54	
54	– 43 E or F Grade
51	
44	
40	
39	
29) 1950	
67 = Mean	
64 = Adjusted Mean*	

* Experimentation showed need to adjust mean downward to 64 in order to increase slightly number of higher letter grades.

DETERMINATION OF SEMESTER LETTER GRADES

At the end of the term or semester it is recommended that the final grade for a course be determined by the distribution of total points accumulated by the various students. In accordance with this system every test or exercise that the students present is weighted by giving it a certain maximum of points. For example, an assigned written report may have a maximum of four or five points for excellent work. Less than excellent work for such reports will earn three, two, or perhaps as little as one point, depending upon the quality of the work. Tests may be weighted at a maximum of ten points for an A grade, eight points for a B grade, six points for a C grade, four points for a D grade, and as little as zero for a complete failure. Variations in these points can be provided in accordance with the judgment of the instructor. Term papers might be given a maximum weight of sixteen points for excellence, with variations for less quality extending downward to eight or seven points. The final examina-

tion could have a maximum of fifteen to twenty points for an A grade, other grades in proportion.

After all of the points are totaled for each student, the totals then can be converted into letter grades in the same manner in which test scores are converted.

ILLUSTRATION II
POINTS AND GRADES EARNED
BY RANDOM GROUP OF A COLLEGE FRESHMAN CLASS

Exercise	Students				
	M	N	O	P	Q
Report 1	5	3	4	4	5
Report 2	4	3	2	4	4
Report 3	5		3	4	4
Written Assignment	4	4	4	4	4
Test 1	B8	D4	F0	B8	C6
Report 4	4	3	4	2	2
Report 5	5	4	4	4	5
Minor Quiz	2	1	2	2	
Test 2	B9	D3	D3	A12	C6
Workbook	2	5	5	5	5
Oral Report	5			4	5
Optional Report		4	4	4	
Report 6	4	4	4	4	5
Report 7		3	4	4	4
Test 3	D4	F0	D4	A14	B10
Report 8	4	4	4	4	2
Panel Discussion	4	4	4	4	4
Optional Work				4	
Workbook	3	5	5	5	5
Final Examination	B12	D6	C9	B12	C9
Term Paper	12	10	12	12	15
Total Points	96	70	81	120	106
Semester Grade	C	D	C	A	B

EXAMPLES OF OBJECTIVE TEST QUESTIONS

Completion Questions

1. The country in which the first experimental psychology laboratory was set up is (*Germany*).
2. A young person with an I.Q. of around 60 is classified as a (an) (*moron*).

True-False Questions

T✓ F 1. The lower limit of the normal intelligence range is the I.Q. of 90.

T F✓ 2. The second largest state in the United States is Montana.

Multiple Choice

1. In experimental studies a control group is used to
   X a. hold all factors constant except the experimental factor.
   _____ b. maintain constancy in size of the experimental operation.
   _____ c. compare different samples of the population.
   _____ d. confirm the results of a preliminary experiment.
2. According to Freud, childhood repression is the frequent cause of
   _____ a. manic-depressive psychosis
   _____ b. schizophrenia
   X c. neurosis
   _____ d. introversion

Matching

1. Match the following tests with their authors. Write one letter before each author.

(B)	Wechsler	A	Revision of the Stanford-Binet
(A)	Terman	B	Intelligence Scale for Children
(F)	Strong	C	Preference Record
(C)	Kuder	D	Thematic Apperception
(E)	Bernreuter	E	Personality Inventory
		F	Vocational Interest Blank
		G	Mechanical Comprehension

2. Match each story with its author. More than one story of an author may be included.

(A)	Huckleberry Finn	A	Clemens, Samuel
(B)	The Deerslayer	B	Cooper, James F.
(E)	The Legend of Sleepy Hollow	C	Harris, Joel C.
(F)	The Murders in the Rue Morgue	D	Hart, Bret
(A)	Innocents Abroad	E	Irving, Washington
(D)	Outcasts of Poker Flat	F	Poe, Edgar
(F)	The Raven	G	Porter, Sidney
		H	Poole, Ernest

Arrangement

(3) The Mexican War
(6) World War I
(2) The War of 1812
(1) The Revolutionary War
(5) The Spanish-American War
(4) The Civil War

RECENT BOOKS ON TESTS AND MEASUREMENTS

Adams, Georgia S., *Measurement and Evaluation for the Secondary-School Teacher*, The Dryden Press, 1956.

Bean, Kenneth L., *Construction of Educational and Personnel Tests*, McGraw-Hill Book Co., 1953.

Gerberich, J. Raymond, *Specimen Objective Test Items: A Guide to Achievement Test Construction*, Longmans, Green and Co., 1956.

Greene, Harry A., Jorgensen, Albert N., and Gerberich, J. Raymond, *Measurement and Evaluation in the Secondary School*, Longmans, Green and Co., 1954.

Ross, C. C., *Measurement in Today's Schools*, Prentice-Hall, Inc., 1954.

The Purpose of College Teaching

"The purpose of college teaching is to induce self-propelled intellectual activity on the part of the student. To teach effectively is to lead, to inspire, and to guide the learner."

Report of A.A.U.P. Committee on College and University Teaching. 1933.

Using Examinations to Promote Learning

Not only may examinations reveal to teacher and students what students have and have not learned, but they may stimulate new learning. Here is a report of purposeful effort by a professor to use examinations to promote learning. The author (M.A., Columbia; Ph. D., John Hopkins) has studied at Oxford and at The Hague Academy of International Law; has been a faculty member at Notre Dame College, Loyola College, North Texas University, Johns Hopkins, and (at present) Marywood College; and is the author of three books and numerous articles.

By JANET BASSETT BAKER

COLLEGE EXAMINATIONS can be made to promote students' learning and at the same time to provide an interesting research project for instructors. Consideration in this article is given to: (1) preparation of questions, (2) marking and using examinations, (3) comments written on tests, (4) additional suggestions for increasing the usefulness of examinations as a tool to improve students' advancement, and (5) conclusions. No differentiation is here made between quiz, test, and formal terminal examination.

▶ First, what can be done about questions so that examinations will have greater value in the learning process? If instructors in their teaching stress certain information and check it as they proceed with their lectures, they can run through their notes, select these high points, and prepare questions on what they emphasized.

If instructors are undecided as to what type of questions to include, they will gain the cooperation of their classes by consulting them. The students may vote whether they wish to have (a) all discussion questions; (b) all short answer questions (chronological sequence, matching, multiple choice, rewrite of the false questions, and completion); (c) a combination of discussion and short answer questions. Some classes do not want all discussion questions because they feel the time allowed for the test may be too short; others do not want all short answer questions because they are not as familiar with this type of test as they are with the discussion test. Nevertheless, is it wise to omit all short answer questions when that is the type of question which appears today on so many professional and competitive examinations?

In the case of frequent quizzes, only one comprehensive question may suffice for a whole test. For instance, the question, "Contrast the politico-socio-economic life of the ancient Romans with that of the ancient Greeks," may be answered satisfactorily in outline form or in paragraphs. Whenever a single comprehensive question is used, it is best to ask the students to *contrast, compare,* or *trace.* Of similar significance are questions whose answers require students to tell *why* and *how.*

Yet other questions may as follows: (1) "Write a dramatic sketch that can be acted in ten minutes. Present Henry VIII and Sir Thomas More arguing about the Reformation Statutes. Give adequate historical information." (2) "In an imaginary diary, which you keep for the years 1914-1918 or 1941-1945, show the attitude of Marylanders to aliens in the state. Write so that you reveal a command of the subject." (3) "Pretend that you are a trader, 1765-1770, and that you travel between New York and Boston. Write a series of letters in which you compare the educational, religious, and recreational activities in New York and Boston. Show that you have done much reading and have done much study of this phase of early American history." (4) "Pretend you are a newspaper correspondent who is sent to cover the Democratic and Republican national nominating conventions (1956). Present portions of the reports which you send to your newspaper. Be sure to write so that you reveal your knowledge of the candidates and their qualifications, as well as their platforms."

Whenever questions such as any one of these four are given, the students often state at the conclusion of the examination, "I do not mind taking this test." "I wish all our questions were like this one." Why do they make such remarks? They welcome the opportunity to create something original, whereas they shy away from such lengthy, old-fashioned, stereotyped questions as these: "Discuss fully (1) Long Parliament; (2) three branches of the American government." Or

(3) "List the causes of the French Revolution and give full details for each cause." Furthermore, such questions are so indefinite that students who have devoted considerable study to any one of them can fill two or three examination blue books. It becomes a physical endurance contest for the students to complete answering the test questions in the time allotted. Instructors who make any pretense of marking such papers will become slaves to the marking pencil; that is, if they do not fall asleep in the meantime. Especially is this true if there are sixty or seventy such lengthy blue books to mark and the grades are due in the office within a few days.

▶ Second, how can examinations be marked and used to advance students' knowledge? Tests should be marked as soon as possible. Instructors may mark the blue books by underlining mistakes made. They may write their comments on the cover page of the blue books. Next they may remove the cover pages of the blue books. The covers may then be filed by the instructor alphabetically. They are then at hand when needed for instructor-student conference or for an analysis of student growth.

A whole period is devoted to the reading and criticizing of the examination papers. Often the papers are compared with various references and source books. Later, during a conference period, the students are given their written pages, shown their good and bad points, and given their grades. Instructors explain to the students how to study, organize material, improve spelling, and consult books. In the conference between student and instructor, acceptable performance is commented upon and ways of overcoming bad performance are explained.

In the conferences some instructors encourage their students, particularly those who make *C* and *D*, to rewrite their examinations. However, the students must do much more studying and that in more than one reference before attempting the rewrite. After rewriting the test, they give the instructors their first and second copies of the examination. If the rewrite shows decided improvement, the students' marks are raised from *C* to *C+* or from *D+* to *C*. Many students welcome the chance to raise their marks by doing over the test in a more satisfactory manner. If asked how they feel about the retake and how it helps them, they say, "I feel that I know the subject better." Instead of rewriting the examination the students may come into the instructors' offices for an oral quiz. Some instructors talk over the test as they and the students sit in the lounge.

▶ Third, what comments do professors write on the papers as they correct them? Perhaps many college instructors will be surprised if they remove the blue examination book covers from the files and catalog the remarks which they wrote on the examinations. Below are a list of faults which one instructor throughout the academic year wrote on the papers of 112 students in history and political science.

COMMENTS	Number of times written on tests of 112 students
Contradiction of statements in different paragraphs	4
Omission of essential information	17
Not legible; pay attention to penmanship	6
More study required for mastery of content	7
Meaning is not clear	25
See text or other reference to substantiate your statement	19
Too many generalizations without enough illustrations	15
Essay (discussion) question is poorly organized	7
Short answer questions are very unsatisfactory	8
Avoid making such remarks as "I believe," "I hope," and "In my opinion"	7
Additional reading needed	27
Too many unnecessary words	15
Capitalization, punctuation, tense sequence, spelling, indefinite antecedents, inadequate development of main theme, poor penmanship	49

A study of the same 112 examination papers for the good points which the same instructor wrote yields the following results:

COMMENTS	Number of times written on tests of 112 students
Well expressed	17
Well organized	18
Shows improvement in mastery of content	18
Neat in appearance	16
Shows you have done considerable collateral reading	18
Short answer questions are well done	20
Discussion (essay) questions are well done	14
Congratulations on producing an examination which I enjoyed reading	10
Fine imaginary conversation, interview, diary, or dramatic sketch	16
Penmanship is excellent	3
I took the liberty of showing this *A* paper to the head of the department	2

A comparison of the instructor's comments which are good with those which are bad shows he is trying to give students specific guidance. He is anxious to have the students improve their work with respect to knowledge, organization, scientific thinking, and study habits. The forty-nine faults found in capitalization, punctuation, tense sequence, spelling, indefinite antecedents, inadequate development of theme, and poor penmanship reveal the instructor's efforts to make his students

practice what they have learned in the English classes. If the students fail to show this command of English, the instructors in biology, history, political science, and philosophy will have to provide it. Mistakes which are found on several papers may be presented to the whole class. The conference hour offers opportunity for the instructor to help each student with his special problems. The favorable comments may be used by instructors as positive psychological approaches to the interview. Even one pleasant comment on a paper gives the student a feeling of satisfaction which he would not have if all the remarks are negative. What's more, he knows by the instructor's definite comments that he has carefully read and graded the paper.

To break down the student-instructor barrier which may exist during the conference have the conference in thoroughly social surroundings. Instructors may serve coffee or soft drinks in their office during conferences. If instructor and student take a walk on the campus, any unpleasantness associated with the conference hour may be eliminated, for once outside the classroom students are free from its restraint.

▶ Fourth, how can other procedures be used to increase the usefulness of college examinations? In the English department of a certain college, the head of the department and his members drew up a mimeographed sheet of instructions for marking and grading examinations. Each student and each instructor was given the sheet. Here is a standard of achievement with which both instructors and students are familiar. Portions of it are as follows:

> The *A* paper shows originality of thought in stating and developing a central idea. Its ideas are clear, logical, and thought provoking. It contains all the positive qualities of good writing listed below; namely,
>
> a. Careful construction and organization of sentences and paragraphs.
> b. Careful choice of effective words and phrases.
> c. Concentration on a main purpose, with adequate development and firm support.
>
> The grade *F* indicates failure to state and develop a main idea. What's more, it may even indicate failure to avoid serious errors in grammar, spelling, punctuation, and sentence structure. (Of course there are standards also for papers which receive a rating of *B*, *C*, or *D*.)

Another interesting step which the English department followed is this: The instructor and/or the head will discuss a student's examination with him at any time; but once a mark is set, no one is allowed to change it.

Students whose average is *A* throughout the course may be excused from taking the terminal semester examination. Thus honor students are rewarded for their honor work. Such a practise always stimulates efforts to produce effectively.

Oral examinations may take the place of written examinations in many instances. Especially is this true where students are handicapped.

The grade made on the formal terminal examination is not the only mark that enters into the determination of the students' final semester mark. Classwork, outside reading, creative activities, and research papers also enter into it. The instructor may be more interested in the picture of progress or the opposite which test papers reveal. For students whose marks show a rise, the instructors may disregard poor marks made at the beginning of the course. Also, for students whose marks show a decline, instructors may disregard good marks made at the beginning of the semester.

Lastly, in order to utilize marked examinations fully, college instructors should ponder reactions of pupils to the examinations. For example, the following comments which seniors made after taking tests are very illuminating: "Daily class recitations rather than written papers indicate students' grasp of the subject." "I wish examinations were farther apart and not so much emphasis were placed on them." "I like unannounced rather than announced tests for they are a truer measure of what the students know. In the unannounced tests there can be no cramming." "A weekly quiz is good because then the students will keep up their daily work." "Tests should vary from short answer tests to comprehensive discussion questions." "Students' grades should be more dependent on outside reading and original projects than on examinations." "Examinations should be done away with except for the final comprehensive at the end of the senior year."

▶ Fifth, with respect to the usefulness of tests as psychological and educational practices to promote learning, what conclusions are reached?

1) When carefully marked, critically evaluated in a period that follows the taking of the examination, and discussed in the conference hour, the examination papers will show the students how they have been weighed in the balance and, let it be hoped, not always found wanting. Students who are not stimulated to improve their work

after such methodology need to see the college personnel director.

2) By not giving the students the marks which they made on tests until they attend the conference means that the instructors will be more than sure of having them come to the conferences. Once they come, then the instructors may offer them help and guidance in an informal discussion in which they show the students all the comments that appear on the marked papers. Furthermore, the students cannot raise a mark from *D*+ to *C* unless they come to the conference period to get their papers.

3) Students who are thoroughly prepared at all times will be far less afraid of an announced test than those who have not done adequate studying. Insecurity may be the foundation for much of students' nervousness at examination time. The excusing of honor pupils from a quiz may stimulate others to get *A* grades.

4) A standard for marking papers will help students measure up to what is expected of them. When they know what is required of them, they cannot intelligently expect to graduate with substandard work.

5) The marking, critical evaluation, and conference hour are all predicated on the bases that examinations are useless unless used to further the students' learning. What's more, examinations should not only increase pupils' mastery of the content of a course, but they should also help them to think intelligently, to use acceptable English in every course, and to improve continuously throughout the year.

6) All college instructors are instructors in English.

7) College examinations are not to be regarded as repetitious chores, dreaded alike by students and instructors. College examinations are to serve as tools for improving instruction. If examinations do not promote learning then something should be found to take their place.

When Facts Know Their Master

"What is our life but an endless flight of winged facts or events! In splendid variety these changes come, all putting questions to the human spirit. Those men who cannot answer by a superior wisdom these facts or questions of time, serve them. Facts encumber them, tyrannize over them, and make the men of routine, the men of sense, *in whom a literal obedience to facts has extinguished every spark of that light by which man is truly man. But if the man is true to his better instincts or sentiments, and refuses the dominion of facts, as one that comes of a higher race; remains fast by the soul and sees the principle, then the facts fall aptly and supple into their places; they know their master, and the meanest of them glorifies him."*

EMERSON: History.

The Examination

Concluding his series on the "Inquiry" approach to biology, Dr. Hatch here describes a new type of examination, giving examples, also its theory and practice. Note that the examination is thought of, not merely as a testing but as a teaching device. It has been a privilege to publish this notable series and we believe hundreds of our readers regard it a privilege to read these challenging accounts of "The Socratic method in modern dress."

By WINSLOW R. HATCH

THE EXAMINATION at the end of a course, like the tail of the dog, can, and often does, "wag" the course: for the examination can, and sometimes does, determine the kind of course that is taught. Courses that are appropriate to higher education should be responsive to the purposes of such an education. If a concern for critical thinking and ideas is a primary or even secondary purpose of a course, the examination should examine accordingly; the course should determine the nature of the examination; the dog should be in control of his tail.

WHOSE EXAMINATION IS IT?

While the teacher is usually, and rightly, held accountable for his course, for his examinations, and for the grades he turns in, his is not always the exclusive responsibility. If he is generously endowed with moral and educational fortitude, he can make himself master of his course and of his examination. Teachers, however, are subject to most of the leveling pressures that beset their fellowmen, and the courage of one's conviction comes no easier to teachers than to anyone else. And so the teacher is not always master in his own house. It is not always *his* course *or his* examination. Putting last things first, whose examination is it?

One of the lesser known authors of our examination is to be identified in the answer we sometimes make when students ask us about our examinations. When such a question is put to us by an irritated but uncommonly good student, it is not uncommon for us to point out that examinations are not entirely of our ordering. There is the institutional grading system, for instance. Where this system defines grades in percentages—an A equals 95% to 100%, a B equals 85% to 95%, etc.—the blame, or credit, for the examination is shared with the institution. The faculty and administration of such an institution has a hand in the writing of every examination, because the grading system tends to compel the teacher to write examinations in which some 5% to 10% can make a score of from 95% to 100% and 15% to 20% of his students can earn grades of 85% to 95%. With such a regulation on the books, what does any smart (or, for that matter, any conscientious) instructor do? He asks questions that 5% to 10% of his students can answer with great accuracy and completeness and that some 15% to 20% can answer well enough to miss perfection by no more than 15%. He cannot risk many really searching questions, and he does not dare ask his students to think very much. The only sensible—and certainly the safest—thing to do is to ask questions on material that can be memorized. To the extent that this rule, this system, is honored, to that extent the institution writes the examinations. Since the examination tests, or should test, what is taught, the course, like the examination, will stress memory. If, as Montaigne observed 380 years ago, "to learn by rote is no knowledge,"[1] this system and these examinations take us out of the educational business, or at least, out of the business of higher education.

Since the pressure toward conformity is great both on and off a campus, one may hesitate to renounce the memory-emphasis examination, whether or not it is supported by an institutional system. One would certainly hesitate to encourage someone else, particularly some innocent young teacher, to write a different kind of examination and teach a different kind of course when he is not likely to be thanked for his pains by the administration, his students, or his colleagues. An examination that emphasizes memory is not likely to be challenged by students. It is the departure from this type that draws their fire. They have been memorizing for twelve or more years, have become addicted to it, and see in it their best guarantee of a good grade. Then, too, the students could presumably insist upon conformity with the institutional grading system—and the administra-

1 Montaigne, "Essay on the Education of Children."

tion would have little choice but to enforce such a system. To expect one's colleagues to endorse a practice that might raise questions about their examinations is to expect too much. When you add to these considerations the fact that the memory-emphasis examination is easy to write and is often "objective"—and hence easy to defend—it is evident why so many teachers yield up their pens. Finally, teachers, and particularly teachers of lower division courses, are very likely to tell you with more truth than ill-grace that their teaching loads do not permit the writing or grading of more searching examinations, and that the calculation of loads does not include such a factor; that they have no choice but to write the quick and easy type of examination. Then, too, of course, one must protect his time for research; he is naive to do otherwise. But the better student knows he has gotten and is getting a shoddy deal. The young instructor who hated this type of examination when it was perpetrated on him finds it hard to live with himself and that same old memory-emphasis examination. Even some hard-bitten old sinners know that they have compromised their principles and that their reward will have to come in research or in administration—if it comes at all. It cannot come from their teaching because one cannot be a good teacher and give this kind of examination and teach the kind of course it imposes.

Just itching to share the blame with the teacher is the predilection of our time, objectivity. Objective examinations are sometimes represented as being "fair" to students because they are objective. But are they? In most objective examinations the student has little opportunity to demonstrate his ability or inability to think or his competence with ideas. It takes a careful, tightly written paragraph to express and defend an idea. When one communicates with his professor by checks, marks, or by underlining a word or at most a phrase, his verbal ability is, to say the least, cramped. Does it matter that the justifications of objective examinations as given by most teachers are usually specious? Isn't it enough that they are popular? Of course it matters. Tell an instructor his teaching is no credit to him and he will be hurt; it matters a great deal to all of us. Why, then, do we put up with this type of examination? The students' enthusiasm for it is not flattering to us; they do not say so, but the implication is clear enough—they do not trust us to write or grade an essay examination.

A good objective examination does, of course, test the student's ability in critical thinking, in analysis, in determining relevancy, in deduction, in generalization. But given a problem, the real trick is to select the correct analytical technique from among many. Where relevance is sought in the material offered in an objective examination, the relevant and irrelevant facts and hypotheses are relatively few in number. The student usually does not have to identfy the relevant fact or hypothesis within a large number of facts and hypotheses. It is certainly more of a test of the student's ability and more realistic to broaden the scope of an examination, because in life one's problems are usually complex and the choices are almost always difficult. Where interpretation is sought in an objective examination, usually only one principle is applicable. The real test is to see whether one can develop alternative hypotheses and select the one most applicable to the circumstances. Circumscribing or oversimplifying is artificial. Integration is most impressive when sustained through a whole examination and course. This is not impossible in an objective examination; but it is exceedingly difficult. And in most objective examinations there is little opportunity for generalization or interpretation.

The observation that students should be spared essay questions because the object is to test their ability to think and not their ability to write does not square with our experience. We have found that when students could not write the answer it was because they did not know it. They either did not have the facts or they could not think through them. For those who have the facts and can think about them, the short answer or essay type of question enables them to show off their knowledge and their thinking to best advantage. And, conversely, those who are "kidding" themselves and would like to fool us find that they cannot do either on an essay examination.

The memory-emphasis and the objective examination, or any examination that does not teach, misses a wonderful opportunity. Suppose our examinations were designed to educate and did educate—what kind of examination would we write? Among other things we would want the examination to help the student evaluate himself—but how, in a memory-emphasis objective examination, is a student going to discover what talents he has, or lacks, in analysis, in interpretation, in generalization, or in expression? Painful as such discoveries sometimes are, each of us needs to know the extent of his knowledge or of his ignorance. When

we enable students to "kid" themselves, as we do, permitting students with a C mentality to memorize their way to an A or B grade, how helpful have we been to them or to society? When students with an A mentality are unwilling to memorize their way through a course and settle for a C, just how good an examination have we put together?

In that first flush of excitement at the beginning of a semester we sometimes make the dangerous statement that, if nothing else is accomplished, we hope that the class will acquire a basic understanding of the principles and methods of the discipline being taught. Any literal minded student would assume that the examinations in such a course would test his understanding of the course. When, in the first examination, he finds that all that is required is a well-assimilated vocabulary or an ability to make simple associations, that a word in this blank or a check in that bracket will do, he knows that he has been cheated. An essay-type question, particularly in the sciences, is a rare experience for both teacher and student. It may be that the teacher just cannot stand to learn the truth. Certainly it is hard on the teacher's ego to grade an essay question when a student makes the right response in the first sentence, and then demonstrates in the next that he does not have the slightest idea of what he is talking about; that the material just has not been taught. For the student, it can be just as painful, but it is important to him to learn what he has not learned.

Our experience with those students in an introductory science course who assert that they have a "mental block" as far as science is concerned, is that their "block" is really a communications "block." They not only lack an adequate knowledge of the language of science, but of the English language as well. When the freshman comes to his first science course from an English class, or from listening to an eloquent invitation to learning from a president or dean, where he is very likely to have been told that it is essential for an educated man to be able to read, write, and speak good English, he presumably expects his science teacher, an educated man, to hold him to some kind of an accounting for the English used in examinations. If his instructor shows little concern for his English, he can only conclude that professors, for all their airs, deans and college presidents, for all their fine language, are, at least upon occasion, frauds—their deeds show so little resemblance to their words.

If our examinations do not require thought, if they are not a good measure of a student's scholarship and they do not instruct, they could be worse than useless; they could subvert education, they could give it a bad name. This may be the explanation, in part, for that anti-intellectualism that characterizes the times. If our examinations are, even in some part, educational debits, we ought to do something about them. What we have to do is not easy, but it is very satisfying.

Should we not accordingly look to our deeds, should we not do what we profess? What we profess is well known, because we make these professions before large audiences, namely, that an examination should primarily be a test of knowledge and not of memory. It follows, we believe, that integration is essential to an examination and a course.

Charles Malik concludes that *"higher education ought to produce the cultivated citizen, who thinks and leads."* If he should be correct, we are under some obligation to produce examinations that measure the student's ability to *think*. Memory is essential to any course and any examination, but it should be only a means to an end. And again, how do we teach our students to lead, if we only ask them to mimic?

In large introductory courses there is a good chance that promising students may not be identified as they should, or as soon as they should. Why not make the examination a magnet that selects and identifies these students? The kind of examination we have been talking about is designed for all students; but it is a good examination for the good students because it stretches the best of them. Something can also be done in the grading of examinations. Our practice is to recognize good performance in a brief note across the corner of the paper. These notes inform the student of his position in the class and in the examination and, where any particular ability has been demonstrated, we comment upon it: "You show a nice talent for analysis," or interpretation, or generalization, or expression, as the case may be. Sometimes we are critical. We also look up the student's class in college and his major, if declared. This enables us to urge the freshman to even finer accomplishment and to congratulate the upperclassman upon his maturing scholarship. Identifying him with a major has, among other things, shown that there is no "mental block" for science among students who come from the humanities and social sciences, but that there may be

a science block for students in technological subjects.

An Examination as a Teaching Device

An examination should, we believe, in part be a teaching device. If an examination is a teaching instrument, a good examination, like a good lecture, should, at the outset, state its theme. First, the test should, in our opinion, have a title. Second, it should, if possible, be a fresh and hard-hitting title. Then in the first paragraph—in as few words as possible—it would seem desirable to indicate what the examination aims to teach. If the examination has subsections, these sections, too, should be introduced by topic sentences. A very considerable amount of teaching can be done by these simple devices. There are few opportunities in a course as good as the examination for giving the students that overview, that synthesis, which is required if they are to develop any real understanding of the course and are to demonstrate their scholarship. If the material being examined has a structure, an organization, it should be apparent in the examination. In a situation where a grade and status are involved, a little humor may not be out of place. It could thaw the freeze to which some students are prone.

If it is a teaching device, an examination should not be a surprise party. If the class has been thinking and talking about important things and the examination deals with important things, it should not surprise. The examination should, however, appear in a context that is new to the students, so that they will have to think their way through it. If in other meetings of the course, some critical method has been used, the students should not be surprised if they are asked to employ this method in the examinations. The type of examination we have been talking about will also discourage cramming. If a student has not gotten his facts as he went along and has not done some thinking about them before he takes the examination, his hasty cramming is not likely to do him much good.

One of the most difficult things to teach in a biology course is holism. To help teach this idea in our course,[2] we use graphic illustrations to give the concept all the vividness and substance we can. This is the explanation for the use of wheels, pies, circus tents, and so forth, in our examinations. We also choose our metaphors carefully. To suggest that continuity in time and space which is important in biology, we use the figures *stream* of life, *tapestry* of life, and *tree* of life. Another integrative approach is to take some very small "bit" of biological material—a seed, a zygote, a chloroplast, a muscle fibril, a chromosome, or even a protein molecule—and show all the interrelationships and dependencies that exist between it and other parts and functions in widening circles of complexity and inclusiveness. This technique explores and exploits the physical, physiological, morphocytological, ecological, and evolutionary setting of our dab of protoplasm.

A New Kind of Examination

We have been experimenting with examinations, feeling our way, for several years. The first results that we have had the temerity to inflict on the general public were put together more than a year ago. We were frankly surprised at the interest shown, and derived enough encouragement to redouble our efforts. When examinations are approached in this way, the writing and grading of an examination becomes an experiment, a fascinating, and we feel, significant experiment. The examinations to follow are not complete. The overall pattern or framework is faithfully reproduced, but, in the interest of brevity and the reader's patience, we make one or two questions serve as samples.

There is a similar pattern to all our examinations:

1) Each has two titles. The first indicates the particular emphasis of the examination: any examination for any given semester is tailored to the requirements of the class, and according to the current emphasis. We try to make this title catch the student's eye and interest him in spite of himself. The subtitle is the heading used year in and year out for the block of work on which the student is being examined.
2) Each examination is introduced by an explanatory paragraph in which its objective and the problem at hand are stated.
3) Each examination has one or two long questions. The rest are short-answer questions. Some require association of structure with structure, function with function, and structure with function. Other questions examine the student's ability to develop hypotheses, check and test hypotheses. Some are after integration, something we believe to be very close to real scholarship. All assume a knowledge of facts but ask for more than simple recall. Some test analysis, some have an eye for relevance; some test powers of observation, some ability to develop or test hypotheses, some mastery of generalization. We find it highly desirable to show the student that

[2] An Integrated Course in the Biological Sciences, taught at the State College of Washington, reported upon "Teaching an Integrated Course in the Biological Sciences," *Improving College and University Teaching*, May 1953, pp. 3-11, reprinted in *Main Currents*, March 1954.

an argument is impressive only when it can be documented with a bill of particulars. We want to be sure we are not getting vacuous generalizations.

4) At the top of each examination there are two brackets, one for the student's "biology" grade and one for an "English" grade. The paragraph explaining this to the students reads as follows:

"We believe there is a direct relationship between one's ability to use the English language and his success in a science course. In the second bracket on the front page we shall indicate your grade in English usage. This grade will reflect your competence in spelling, sentence structure, and choice of language. The only penalty attached to poor English is that which is inherent in it, namely, that it may cause you to do less well in this course than you otherwise might. This evaluation will not be counted as a part of your grade, but it may explain your grade."

To discourage complacency and to give as little ground as possible for the too satisfied remark, "Well, I made my A or B" (or even, "my C or D"), we report the results of the examination in a class listing that shows the top score. We do not identify a score with a name, but let each student do this for himself, and in the process see just where he stands. Since few are satisfied with their position, the students tend to bear down and improve if they can. This simple reporting practice has proved to be an antidote for frustration and discouragement as well, because one always seems to have plenty of company in adversity.

As a check on teacher and student, we have kept a record of achievement, semester after semester. By using the same number of points each semester, 500, and by analyzing performance —the top score made, mean score of class, failing level, and the numerical level of each letter grade —we can compare the teacher's achievement, the performance of the class, and the relative performance of individuals in different semesters. And what is most heartening to all concerned is that our performance seems to be improving.

One of the awkward things about writing a new kind of examination is that it is not always possible to do it until one has overhauled his course and straightened out his own thinking. One has to be clear in his own mind as to what the significant ideas are before he can ask questions about them, let alone grade the answers. The new examination will not fail because of the students. They do not like to work any more than anybody else; but they have their own self-respect, and they cannot escape from it any easier than the instructor can from his. The people to worry about are ourselves, the teacher and the administrator. The cure is difficult but, once the teacher has taken it, he is likely to develop an extraordinary appetite for teaching, even for writing and grading examinations. Except for the ferment in the faculty, the administration has nothing to lose and everything to gain—a better process, a better product, and fewer frustrated personalities with which to contend. The cure is no less difficult for students who have been memorizing for twelve, thirteen, or fourteen years, but they can, and some will, develop an appetite for learning. These students about whom we have been worrying, these students who do not know any arithmetic, let alone mathematics, who cannot write an English sentence, who seem to resent outside preparation and are happy to settle for a gentlemanly or a womanly C—these students have not developd a resistance to knowledge, they simply resent going to high school for another four years.

When one is critical of institutions, such as the examination, and is full of suggestions as to how others might improve, he would be well advised to "put up" or "shut up." We are, accordingly, "putting up" some sample examinations. In doing so we are aware that the persons being examined are the authors, but we are serious enough to share our thinking and our experience, limited as they both are, and take our "lumps."

It is recognized that one cannot evaluate an examination well without knowing how much the student has been told about the material on which he is being examined. One cannot, for example, determine whether mere recall or real thought is required in answering a question unless one knows the background of the question. For those who would like to convince themselves on this point, we can supply course outlines and the student's preparation for each question. We realize that one examination involves recall to a larger degree than we wish to defend, but we have included it because we think the reader should have a typical sample of the examinations offered so that he may be given some idea of how our concept of the examination changed and developed.

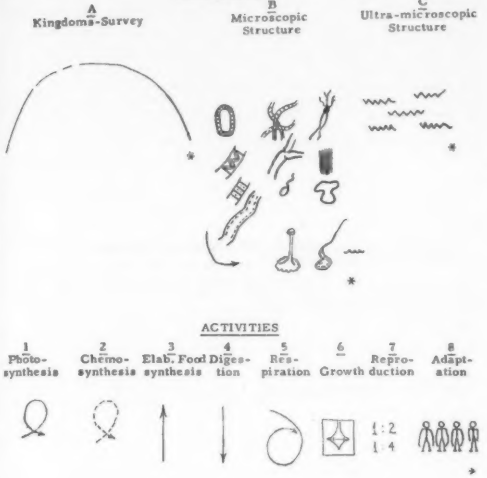
The use of our own biological shorthand and our annoying habit of not labeling the diagrams used in some examinations works a hardship on the reader. For the student no problem was involved here.

I

The Nature of Life
The Structure and Activities of Living Things

The trouble with rote memorization is that there are always so many facts, and the only way one can win is to memorize them all. If one can find the essential ideas that can be distilled from these facts, the facts themselves become meaningful,

and one finds an innate simplicity in them. Let us try to find the ideas, the hypotheses or theories, that are to be deduced from the facts below, represented diagrammatically *A* through *C* for the structures, and *1* through *8* for the activities, studied during the past few weeks.



From the facts assembled under the headings on the preceding pages, we can develop a simple statement about the origin of life.

1. If the first living things were simple in their structure and function, which of the organisms represented diagrammatically in *A* would make the bes models? Explain.

2. Taking into account what you know about *A* and *C*, draw a picture of the first living things.

3. Indicate by word or diagram the material which must have existed in the environment of the first living things, the material which furnished them with their source of energy.

4. If the first living things were to convert this material into protoplasm, sustain life, and reproduce their kind, which of the activities *1* through *8*, would they have to exhibit?

5. Taking into account what you know about the physiological properties *1* through *8*, which living thing in *A* would have the simplest physiology?

6. Explain in what way its physiology is simple.

From the facts assembled under the several headings, we can develop simple statements or hypotheses about the nature of life.

7. What is the structure in *A* through *C* that is essential to any and all living things, and so essential to life?

8. What structures found in *A* through *C* identify animals as animals?

9. What structure found in *A* through *C* identifies green plants as green plants?

10. What is the evidence that not all living things can be neatly classified in one or the other of these kingdoms?

11. Let us turn now to the activities of living things. What is there about any one of these activities that identifies it as a living property in contradistinction to some single activity of inanimate objects?

When we view all of the activities *1* through *8* we find that physiological properties of living things have a quality not found among inanimate objects, namely, that they must possess *all* of these activities and exhibit a total response, or as we sometimes say, an organismal response.

12. In what respect is photosynthesis dependent upon respiration?
In what respect is photosynthesis dependent upon elaborate food synthesis?
In what respect is elaborate food synthesis dependent upon photosynthesis?
In what respect is reproduction dependent upon growth?
In what respect is adaptation dependent upon sexual reproduction?

13. We also say that growth is an organismal phenomenon, that the organism *determines* the pattern of growth. *Illustrate* and *explain.*

14. Adaptation is also an organismal phenomenon and involves the adaptation of the whole organism. Explain why this must be true.

15. Let us complete our examination by drawing off the most significant ideas to be found in the facts under the headings:

(A & B) The idea to be found here is a generalization about the nature of life and is called the protoplasmic theory. What is this idea?

(C) The idea to be found here is a generalization about the nature of life and is called the protein molecular network hypothesis. What is this idea?

(A) Animals are grouped together presumably because they have structures in common. Why do animals have these structures in common according to the Taxonomic Theory, another theory or idea bearing on the nature of life?

(B & 6) From an analysis of *B* and *6* it is possible to conclude that cellular organization is *not* an identifying characteristic of living things. What is there about the facts under *B* and *6* that supports this conclusion?

II

The Fine Points of Baseball
The Whole Animal

1. All too few baseball fans seem to know what is *really* happening when the clutch hitter digs in at the plate. First of all, they don't know *what kind of muscles* he is using to grasp the bat. In the space below, *draw* and *label* such a muscle fiber so that others may begin to learn some of the fine points of the game.

2. How has the *mass* of this muscle been increased since the days the best the batter could swing was a rattle? Draw a cell below and show the result of *free nuclear division.* If a true cell divides, it divides by *cell division.* Draw a cell below, and in a second drawing show the result of *cell division.* In accounting for the development of muscles we make certain assumptions. We say, for example, a striated muscle is *noncellular.* This brings us indirectly to a problem of definition: What is a cell? Explain what was wrong with the assumption called the *Cell Theory,* the theory that all living things are composed of cells or exist as single cells.

3. A batter grasps the bat with all *five fingers* of both hands. The forepaws of most mammals, the flipper of a whale, the wing of a bird, and the limbs of a lizard or a frog, have *five digits.* According to the Taxonomic Theory, why do all of these animals possess five digits?

4. What is there about a man's hand that enables him to get a better grasp on the bat than these other animals could?

5. The whole business of batting is a matter of *muscles* pulling on bones. How, in one arm, can the batter have tissues as different as *muscle* and *bone?*

6. To the really discerning fan, there is a *basic explanation* for *muscular* contraction. What is the ultimate, ultramicroscopic explanation for the ability of a muscle fiber to contract?

7. Most fans don't seem to know even how the blow is delivered. The credit is usually given to "the wrist-action," or to "the way the shoulders are put into it." But we know that it is *A.T.P.* that does the trick. What is A.T.P.? Where is A.T.P. found in the batter? What does A.T.P. do for the batter?

8. When he swings, what triggers the A.T.P. into action? Where does this substance come from?

9. How does the ballplayer "recharge" his muscles so that he can run to first base?

10. As he races toward first base, what parts of his body are *not* playing baseball? List them:

The running ballplayer illustrates a theory that we have been discussing since the beginning of the semester; the idea that the *entire* organism is involved in activity. What do we call this theory?

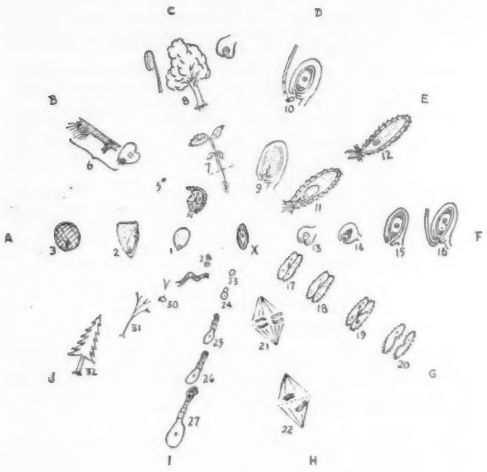
---

* In the presentation of this material in lecture, demonstration, and dialogue we developed a kind of biological shorthand. The four arcs *A* are our diagrammatic representation of living things, the twigs of the tree of life, *B* = comparative cytology; *C* = a protein molecular network. Photosynthesis (1) is represented as a loop in a spiral; Chemosynthesis (2) a dotted loop; Elaborate food synthesis (3) an arrow pointing upward; Digestion (4) an arrow pointing downward; Respiration (5) a cycle Krebs, with stem, glycolysis; Growth (6) mitosis and cytokinesis; Reproduction (7) a 1:2 ratio for asexual reproduction, 1:4 ratio for sexual reproduction; Adaptation (8) the four cavemen, one of whom could adapt. This shorthand does what all shorthand does—by an arrow, a spiral, or an arc one can suggest what otherwise would take many sentences to say, and the symbol appearing day after day on the blackboard shows the students how nececssary and useful certain facts are. The symbol seems to be more effective for this purpose than the word.

III
The Big Wheel
The Whole Plant

Since a lot of splendid, full-blown language has already been used trying to explain what understanding is, we shall eschew the literary and see what we can do with a simple little game called "follow the dots."

Knowledge of a course may look like the diagram below, a mass of seemingly irrelevant, unrelated, uninterpreted—and hence ununderstood facts. You could memorize all these facts, but you would not understand an apple tree. What you have to do is to relate these facts. But how does one do so? First, like an I.B.M. sorting machine, our brain has to pull out the relevant or related facts. We have done so in our diagram. Then by induction or dedeuction we have to interpret these facts. Your answers to questions 1 through 17 are your interpretations, your hypotheses.



1. **(Join the dots X, 1, 2, 3)**
One cannot appreciate what makes an apple seed a seed without comparing it with other seeds. A skunk cabbage seed is made up of endosperm and embryo but has no seed coat. A corn grain, with fruit coat removed, is composed of seed coat, much endosperm and embryo; a pinion pine seed has a seed coat, gametophyte or thallus, and embryo.

a) What structures of an apple seed make it the entity known as a seed?

.....

b) Why did you make the choice you did above? .....

.....

2. **(Join the dots X,4,5,6, and X,7,8)**
The "brown dust" that falls from a fern sporangium is made up of spores. Seeds and spores germinate to form plants, but there is a fundamental difference in the immediate product of spore and seed germination. Check the correct parenthesis below.

a) Spores germinate to produce a sporophyte ( ), gametophyte ( ).

b) Seeds germinate to produce a sporophyte ( ), gametophyte ( ).

c) How do you know in (a) above that the plant is a sporophyte or a gametophyte?

.....

.....

d) Now draw such a plant.

e) How do you know in (b) above that the plant is a sporophyte or a gametophyte?

.....

f) Now draw such a plant.

3. **(Join the dots X,4,5,6, and X,9,10, and X,11,12)**
From what you know about flowering plants or ferns what would you deduce the IN food source for the developing embryo of conifer seeds to be?

.....

4. **(Join the dots X,13,14,15,16, and X,17,18,19,20)**
One cannot really understand what a seed does for a plant unless one appreciates that a seed is the product of sexual reproduction and understands what sexual reproduction is and what sexual reproduction does for a plant.
a) What is the *proof* that sexual reproduction involves:

Meiosis .....

.....

.....

.....

.....

Karyogamy .....

.....

.....

b) What does meiosis do for the plant?

.....

.....

c) What does karyogamy do for the plant?

.....

.....

d) What is the biological or overall significance of sexual reproduction?

.....

5. (Rejoin the dots X,13,14,15,16)
Where does sexual reproduction occur in the formation of a seed? Identify the actual cells and nuclei involved. .....

.....

.....

6. (Join the dots X,21,22)
One cannot appreciate what sexual reproduction is unless one knows something about growth. Growth involves cell division or free-nuclear division, and these two processes have one thing in common, *mitosis*. In sexual reproduction another kind of nuclear division is involved, namely *meiosis*. Under the headings below indicate opposite (a) the number of sets of chromosomes, 1N, 2N, 3N, in a nucleus before it divides mitotically and (b) the number in its daughter nuclei. Indicate opposite (c) the number of chromosomes in the nucleus before it divides meiotically and (d) the number in its daughter nuclei.

Mitosis		*Meiosis*	
a.		c.	
b.		d.	

7. (Join the dots X,23,24,25,26,27)
In the embryological development of a plant such as the apple tree the zygote divides in a horizontal plane to form an embryo and a suspensor cell. Then the embryo cell divides in a horizontal plane to form a 2-celled embryo, and these two cells in turn divide in horizontal planes to form a 4-celled embryo. But now these 4-cells divide many times in vertical planes to form four multicellular initial layers. What determines the pattern of division in this small embryo; in other words, what determines when cells shall divide and how they shall divide?

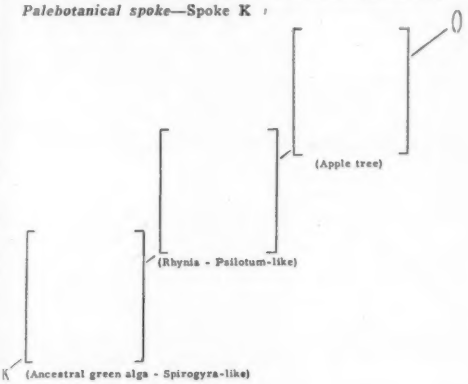
.....

.....

.....

8. (Join the dots X,28,29,30,31,32)
In 3 quick sketches draw and label the sporophyte of:

Palebotanical spoke—Spoke K



9. (Rejoin the dots 28, 29)
What 5 structural or functional features did the Spirogyra-like ancestral alga have that the first green plant, a blue-green alga, lacked?

.....

.....

10. Why do we think that the first living things were heterotrophic?

.....

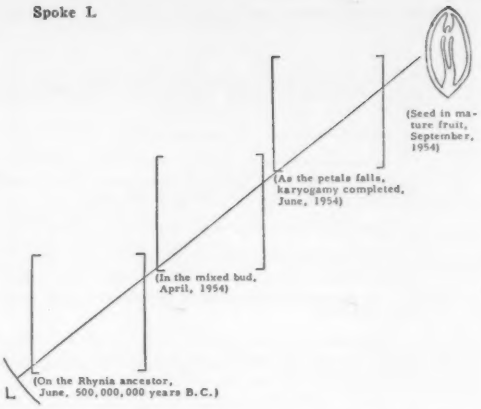
.....

.....

.....

11. (The history of a seed: Draw the seed as it would appear at the dates, and under the conditions indicated. Label your drawings.)

Spoke L


(Seed in mature fruit, September, 1954)
(As the petals falls, karyogamy completed, June, 1954)
(In the mixed bud, April, 1954)
(On the Rhynia ancestor, June, 500,000,000 years B.C.)
L

12. (Rejoin the dots 28, 29, 30, 31, 32)
The embryo in an apple seed is an apple tree in miniature, and apple trees are related:

a) to all angiosperms.
1. What is the evidence of this relationship? .....

.....

b) to all seed plants.
1. What is the evidence of this relationship? .....

.....

c) to all archegoniates.
1. What is the evidence of this relationship? .....

.....

d) to the blue-green algae.
1. What is the evidence of this relationship? .....

.....

e) to the amoeba.
1. What is the evidence of this relationship? .....

.....

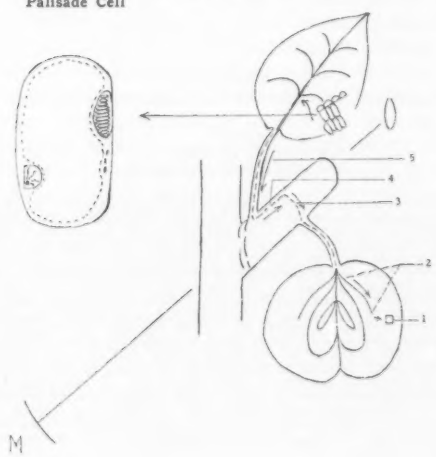
f) to Rhynia.
1. What is the evidence of this relationship? .....

.....

.....

.....

13. The path of a molecule of glucose moving toward cells in an apple fruit is indicated by dotted lines.
Spoke M
Palisade Cell



a) What makes the sugar delivered at station (1) move into the cells?

.....

b) What is the structure in the flesh of the apple fruit, the overall structure of station (2), through which the sugar moves?

.....

.....

c) In the twig station (3) the sugar must move around from the upper to the lower side. How is this done?

.....

.....

.....

d) How do we explain the upward movement of the sugar at station (4)?

.....

e) How do we explain the downward movement of the sugar through station (5)?

.....

f) Note the big excerpt drawing of a palisade cell and tell us:
a) precisely where photosynthesis occurs? .....
b) precisely where respiration occurs? .....

g) In what way is photosynthesis going on in one location in the cell dependent upon respiration going on in another location?

.....

.....

h) In what way is photosynthesis dependent upon elaborate food synthesis?

.....

.....

i) Rejoin the dots A through J and your spokes K, L, M. How did these plants become as different as they are?

.....

.....

.....

.....

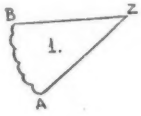
IV

Jack Horner's Pie
An Integrated Course in the Biological Sciences

He used his mind
And what did he find?
Instead of a plum a whole pie.

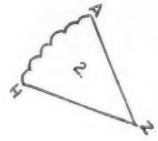
If in this introductory course in the biological sciences you have acquired a basic understanding of the principles and methods of biology, our time has been well spent. We have studied the field from molecule to man, from 2,000,000,000 B.C. to 1958 A.D. Now let us take a good look at a very small but very significant bit of biological material suspended in time, the *zygote*, and try to find out what it takes to understand it. The following diagram appears to be a collection of seemingly irrelevant, apparently unrelated, uninterpreted—and hence ununderstood—facts about zygotes, all thrown together into an open-faced pie. No pie is cooked piece by piece or eaten plum by plum; it is brought to the table whole and disposed of in chunks; and if it is to be full-flavored, it cannot be half-baked. In the center of our pie we have put a big "Z" standing for zygote; this represents the spout which helps to retain the juice without which pies would scarcely be worth eating. Similarly, a course, if not understood, is hardly worth taking. It may not be easy to cut this pie so that you can get out whole pieces, but it can be done.

This is your fact sheet, your "crib." Tear it out and use it in answering the questions that follow.



1. Wedge A-Z-B comes out a whole piece because sexual reproduction amounts to the same thing wherever and whenever you find it. This is so remarkable that it requires proof. *What is the proof* that sexual reproduction involves the same structures, the same processes, and achieves the same result from Man to Paramecium, from Apple Tree to Chlamydomonas? Drawing your evidence from all four of the above-mentioned organisms, take the rest of the page to develop the *proof*.

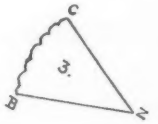
a. What is the thought process, the reasoning, that tells you what these structures, processes and results are?



2. This slab (H-Z-A) looks as though it were going to fall part, consisting as it does of striated muscle, palisade cells, golgi, and chloroplasts; but there is an invisible cement that holds all of these structures together—a cement common to all living parts of all organisms—an ultramicroscopic protein molecular network.

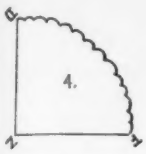
a. How do we know we are not just looking at the emperor's new clothes; if we cannot see it how do we know that it exists?

b. How do we know that it has the structures it does?



3. Slab B-Z-C is held together by the pressure of environmental factors. If you look closely you should be able to discover that *the* environment necessary to maintain life is the same for any and all forms of life—whether this is a zygote safely implanted in a mother's womb or a mountain pine gnarled and twisted by alpine weather. What are the basic components of environment necessary to sustain life as we know it?

Slab B-Z-C could have been removed along with A-Z-B without losing a morsel, because there is a very significant interconnection between sexual reproduction and an environment which presents niches in which life develops. In a few well-considered sentences, discuss this significant interrelationship.



4. When wedge D-Z-F comes out, it emerges so whole as to discourage the most hearty eater, for although living species on the earth today are numbered in the millions, there is the same bond among them all as that which exists between you and your mother. What is this bond that makes us kin to amoeba and apple tree as well as to the virus that lurks in our tonsils?

a. What is the evidence that there is any kinship between you and an amoeba?

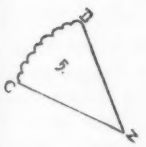
b. What is the evidence that there is any kinship between you and a virus?

c. As you start to cut down through the wedge, you find that the same bond of kinship has existed through countless ages; you find, in fact, that the kinship becomes closer and closer the farther back you look.

d. What theory explains the kinship of living things?

e. What theory accounts for the kinship of living things?

f. Why were earlier living things more alike in form and function than the organisms which comprise more recent floras and faunas?



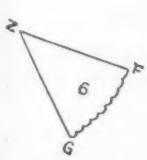
5. The C-Z-D wedge is made up of wholes too. You ought to recognize the sketches as representing stages in the development of the human zygote. Take a few well-thought-out sentences to tell us what it is that determines why all of a sudden some ectodermal cells along the back of the embryo divide faster than the adjacent cells and eventually form a neutral grove. Also tell us whether this burst of growth is initiated by the cells involved, by the ectoderm as a germ layer, or by what?

a. In the development of the human zygote to form 2 and then 4 cells, then more, what kind of nuclear division is involved?

b. State the reason for the answer you gave above.

c. What is the evidence in human embryology that some of man's ancestors were aquatic? List two pieces of evidence.

d. How does this evidence indicate that man's ancestors were aquatic?



6. In slice F-Z-G, which deals with the embryological development of the plant, every stage acts like and is a whole. Let us illustrate: The zygote first divides in a horizontal plane to form a 4-celled embryo. But now these 4 cells divide many times in vertical planes to form 4 multicelled initial layers. What determines the pattern of division in this small embryo; in other words, what determines when the cells shall divide and how they shall divide?

a. What is the chief difference between a 4-celled human embryo and a 4-celled apple tree embryo, as regards the degree of differentiation achieved?

b. What is the evidence that the ancestral apple tree had a thallus?

c. What is the evidence that the thallus had gametangia?

d. What is the evidence that the ancestors of apple trees, if not aquatic, at least lived on ground that was wet or periodically flooded?

7. Wedge G-Z-H must come out whole if it comes out at all. Leave any vital activity behind, and living things have ceased to live. The important thing for us is that life is sustained and new zygotes and new generations are perpetuated.

a. A zygote develops into an embryo and the adult organisms by growth. What is growth?

b. How is photosynthesis related to growth? (Why can't we do without photosynthesis?)

c. How is digestion related to growth? (Why can't we do without digestion?)

d. How is elaborate food synthesis related to growth? (Why can't we do without elaborate food synthesis?)

e. How is respiration related to growth? (Why can't we do without respiration?)

8. You have heard the comment that the real test of a good pie is the crust. It is equally true of this pie. The crust under this pie supports all of the filling. It was made in layers, or hypotheses, but all of the different hypotheses were finally rolled into a single master theory, or bottom crust.

a. The lowest layer of the crust, which lay against the hot inanimate pieplate, is made up of the first living things. Into this layer went strictly heterotrophic organisms. It isn't given to anybody to know that this is certainly the case, but according to the heterotrophic hypothesis you should be able to tell us why it is probable.

b. These heterotrophic organisms had to have food. What was it? And where did it come from?

c. Why did it presumably take some millions of years to produce an autotrophic organism from the original heterotrophic ones?

9. The mystery of the crust can also be fathomed by working down into it from the living filling. How, by a study of the development of living things today, can we discover the order in which structures appeared in the past? Develop this theory carefully enough so that you could convince William Jennings Bryan.

a. The shortening that holds the crust, and thereby the whole pie, together is that master theory we call the theory of evolution.

b. If man were incapable of sexual reproduction what would he lack besides sex organs and secondary sex characteristics?

c. What is the evidence that there has been a real protoplasmic continuity between the first living things and those on the planet today?

d. What is the nature of the protoplasmic bridge between one generation and the next?

e. Why did living things, particularly those on the land, become increasingly diverse?

f. But those who seek will find that the most diverse things are similar in some respect. Why?

The Exercise of Thought

Do our examinations accomplish what they are supposed to accomplish? Without the benefit of any evaluative study that an expert in testing and measurements would find convincing, we can make the simple observation that the students are examined and graded upon questions that test their understanding, their ability to think and to use the scientific method. This kind of examination has been given routinely for some sixteen semesters. That examinations in other courses in the biological sciences do not achieve these results to the same extent is borne out in the testimony of undergraduate majors and graduate students in the departments of bacteriology, botany, and zoology. The undergraduate majors, our graders, originally had to be sought out. Now they seek us out because, as they say, "We've missed something and want this experience. We are about ready for a degree, but we cannot begin to answer your questions." Graduate students, as well, were assigned to the course as teaching assistants. It was their opinion that they had not had this experience in their undergraduate schools and that they had not found it in their graduate program. In their words, "We memorize, we don't think. We are loaded with facts, but

(*Continued on page 136*)

How Is Your Diction?

HOW WORDS FIT TOGETHER by Louis Foley, Babson Park, Mass.; The Babson Institute Press. 1958. 125 pp. Paper. $5.60.

It is a matter of duty to call attention to this important work on English and general language education.

Some of the chapter headings are: Common Sense about Sentences; Comfortable Commas; Helpful Hyphens; Crooked Furrows; Diagnosis of Dislocation; Jarring Echoes; Interwoven Strands. Their very wording suggests the nature of the book, a unique, thoroughgoing approach to the matter of surprising college undergraduates, as it were, into a practical feeling for and understanding of both the simple and the complex ways of the English language. It is doubtful that there is anyone in the country better qualified than the author for this particular labor of love.

So varied is the stock of explanatory and enlightening illustrations of the right and wrong sides of typical contemporary patterns of English usage that any serious reader of this book, even the individual most mature in information and thought on English, will find in it excellent material for personal profit. His capacity for teaching the language, if such is his profession, will without any doubt be enhanced, in specific, unsuspected ways, by the clean-cut and exhaustive exposition of just what to do and what not to do. Whatever books on English and its teaching he may have, he will do well to get this one too—for it is "different."

It would be well too if *How Words Fit Together* would find its way into the hands of contributors to our newspapers and magazines, of radio commentators, of authors of books, many of whom are carelessly allowing their habits of diction to degenerate to norms not much removed from those of average themes turned in in Freshman Composition. The book will bring here and there to these respectable delinquents a salutary awakening.

A. M. WITHERS

(The Examination *Continued*)

we are awfully light in ideas." Of late, graduate students have asked to be assigned to the course, offering to take on this responsibility in addition to any assignment that the department might require of them. Still other graduate students, for whom no place could be made on the staff, audited the lectures; as a matter of fact, there was a whole row of Ph.D. candidates in the lectures one semester.

The foregoing exposition of our theory and method has been made in specific terms in order that it might benefit from the clarity that such treatment affords. It is by no means intended that the specific materials and treatment described here should serve as models for other institutions and other instructors. The end in view, it must be remembered, is the exercise of thought, not the ingestion of prescribed information or ideas. Consequently, while we urge others to consider our goals and methods, we are inclined to fear that borrowing our material and treatment indiscriminately would almost inevitably meet with failure. The results of our thinking are no substitute for that thinking which every instructor and student must do for himself.

Other Recent Books

THE GANG by Herbert A. Bloch and Arthur Niederhoffer. New York: Philosophical Library. 1958. xv + 231 pp. $6.00.

A study in adolescent behavior. "Adolescent gangs may be profitably studied by using as a frame of reference the theory of power." "By this special path we have sought to unravel the hidden motiv ions and dynamics of the adolescent generation of our time."

THE ITALIAN PEOPLE AND THEIR SCHOOLS by Joseph Justman. Tiffin, Ohio: Kappa Delta Pi. 1958. ix + 65 pp. $1.00.

From Introduction by E. I. F. Williams: "This report of a year's study deals with people, places, and activities and is not restricted merely to scholastic accomplishment. It dwells in part on an interpretation of events in postwar Italy."

PHILOSOPHY OF EDUCATION FOR OUR TIME by Frederick Mayer. New York: The Odyssey Press, Inc. 1958. x + 245 pp. $3.00.

Tackles practical problems and helps one develop a philosophy of life and of education. In the process one becomes acquainted with important phases of philosophy and with leading philosophers.

INDEX

A. A. U. P. Committee *quoted*, 121
Air Force training pamphlet *quoted*, 37
Art of Midwifery, 9
AXELROD, JOSEPH, 112

BAKER, JANET BASSETT, 122
BELLOC, HILAIRE, *quoted*, 48
Bibliographies, 89, 95, 121
Books, 32, 99, 136

Chinese Proverb *quoted*, 54
COARD, ROBERT L., 71
College and University Teaching: Its Literature (review), 30. Its Impact (review), 30
Conant's Administrative Discovery of Teaching, 42

Delayed Action Bomb, 110
"Dialog," 73
DOUGLAS, PAUL, 6, 42

Editor's Uneasy Chair, 2, 34, 66, 106
Educational Vistas of Television, 70
Emerson *quoted*, 125
Examination, 126

FADIMAN, CLIFTON, *quoted*, 110
Few Questions to Teachers, 11
Form of Merit, 54
Four Remedies in Crisis, 18
Functions of Graduate Education, 17

Game of Grades (editorial), 111
GLICKSBERG, CHARLES I., 26
Good Teacher, 36
Grasshoppers Must Be Caught, 37

HATCH, WINSLOW R., 21, 49, 51, 73, 126
Higher Teaching (editorial), 3
HORNER, JOHN E., 107
How Is Your Diction? (review), 136
HUXLEY, ALDOUS, 67

Improving Testing and Marking Practices, 115
In Loco Parentis (editorial), 35
Integration and the Humanities, 55
Irving Babbitt: America's Best Remembered Teacher, 6
Is Lecturing Teaching? 26

Journal Sabbatical Year: 1959, 102

KNOWLES, ASA S., *quoted*, 25
KOLSON, CLIFFORD J., 18

Laboratory, 51
Lecture, 21

Manley or a Missile, 104
MANNING, JOHN, 12
MAYER, FREDERICK, 103
MAYER, FREDERICK, *quoted*, 70
McKEACHIE, W. J., 84
McNEW, LOUIS D., 55
MITCHELL, JAMES V., JR., 90

Neglected Purposes in Higher Education, 107
New Directions for the University (review), 63
New Look, 38
NOSSEN, ROBERT, 96

Oliver Wendell Holmes Teaches Anatomy, 71
One of the More Attractice Professions, 25
Other Recent Books, 32, 99, 136

Pantograph (editorial), 83
Personal Thoughts on Teaching and Learning, 4
PLUTARCH *quoted*, 5, 9
President's Commission *quoted*, 17
Professing Ignorance, 5
PULLIAS, E. V., 99
Purpose of College Teaching, 121

Quotable Ideas About Teaching, 10

Recent Books, 32, 99, 136
Retrocession, 98
Reviews, 31, 99, 136
ROGERS, CARL R., 4

Shakespearean Tragedy in General Education, 12
SHAYON, ROBERT LEWIS, *quoted*, 104
STERN, BERNARD H., 60
Swinger of Birches (review), 99

Teacher and Teaching (reviews), 31
Teaching and the Realities of Life, 67
Teaching Educational Psychology by TV, 90
Teaching of Adults, 60
Teaching with Books, 103
TEAD, ORDWAY, 10, 11, 31, 38, 105
Thinking Decides Action, 48
TOMLINSON, LAURENCE ELLIOTT, 115
TOWNE, FRANK M., 55
TV and the Teaching of English, 96
TV for College Instruction, 84
Twelve Suggestions for Improving Teaching, 105

Using Examinations to Promote Learning, 122

VAN DOREN, MARK, 36

"We Have Given Our Lives," 95
WELLS, H. G., *quoted*, 98
What Do College Grades Mean? 112
When Facts Know Their Master, 125
When Students Play on the Team, 49
WILSON, WOODROW, *quoted*, 95
WITHERS, A. M., 136